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ABSTRACT

Presently available telecommunication technology was surveyed to ascertain how it might be used to deliver public services. Applications are proposed in the fields of medicine, education, and social welfare. Specific designs are proposed for implementing the proposals, including applications of interactive television, cable television, computer data banks with telephone access, videotape and computer hookups, home use of interactive television and two-way institutional networks. Costs and hardware requirements are analyzed for videotape, teleprocessing, cable television and other systems. Problems of instructional constraint and implementation are discussed, and policy questions are identified. An appendix in chart form analyzes the cost and hardware requirements. (SK)

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ABT ASSOCIATES INC.
55 WHEELER STREET, CAMBRIDGE, MASSACHUSETTS 02138
TELEPHONE • AREA 617-492-7100
TELEX 710-320-6367

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A Planning Study to Develop a Demonstration Design for the Use of Telecommunications in Public Service Delivery

FINAL REPORT
June 30, 1974

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Office of Telecommunications Policy
Department of Health, Education and Welfare
North Building
Room 5524
330 Independence Avenue, S. W.
Washington, D.C. 20201

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The Abt Associates team for this study included David MacFadyen, Area Manager, Technology Management Group; Samuel Carradine, Project Director; Dr. Roger B. Fransecky, Technical Director; Ralph Lee Smith, Senior Consultant; Deborah J. Blackwell, Deputy Project Director; and Robert F. Stone, Economist. Dr. Albert Horley is Director of the Office of Telecommunications Policy, HEW, the sponsors of the study, and Sherrill McMillon served as Project Officer.

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I.0 INTRODUCTION

Over the past several years, there have been many attempts by both Federal, state, and local governments, as well as by private foundations and other institutions, to describe and place into perspective the potential that telecommunications offers for increased public service delivery. To say the least, the results have been mixed. Several projects were funded after various planning studies were made and many of these efforts successfully demonstrated the utility of telecommunications technology in service delivery within their given context. Other projects have shown that due to institutional constraints, "human factors," or inappropriate technology utilization, telecommunications has been a less than satisfactory answer to the problem. In other words, planning studies and actual demonstrations have run the gamut from success to failure, and have examined the range of technological options. Thus, the status of further examination remains unclear. The National Science Foundation's recently funded studies of two-way interactive applications of telecommunications to social services is an attempt to make the leap from generalized planning to actual comprehensive service delivery, and this is indeed a step to be commended. So too, this study is hopefully a stride in the direction of reality.

Part of the mandate of the Department of Health, Education, and Welfare, Office of Telecommunications Policy, was that Abt Associates develop a design using proven technology to demonstrate innovative and cost-effective means of service delivery. As a result our approach was to focus on the need and market for particular services, so as to avoid the perennial scenario of "technological solutions in search of social problems." When looked at more carefully, many of the solutions were not as appropriate as first envisioned; however, the problems continue to be readily apparent. Lack of social services to the rural isolated and urban poor need not be documented, nor are the failures of the education and health care systems in this country especially elusive.

Too frequently, telecommunications is viewed not only as a panacea for the alleviation of social ills, but also as a means of unearthing service needs that had not been previously recognized. This is surely not the case. In fact, one of the hard truths that must be faced by telecommunications planners is the limitations of the technological applications that are being suggested. A corollary to this is that not all "traditional" service delivery mechanisms have failed. Often with additional resources, traditional service delivery mechanisms have proven to be extremely effective, precluding the need for increased technology and reaffirming the "human factor" aspect of service delivery.

The Telecommunications User Advisory Committee, formed for this study, was composed of individuals with experience in social service delivery and telecommunications applications. (See Appendix A). This groups was extremely helpful in specifying target populations with prime needs which might be effectively met through telecommunications-based service delivery systems. The Committee identified groups which now receive inadequate or no social services as the most important targets for demonstration projects; in particular specifying minority group members, non-English speakers, public assistance recipients, the elderly, the handicapped, the poor, and those who are socially and economically isolated from traditional social service delivery systems. It was felt that at present, health, education, and social service providers lack financial and other incentives to provide comprehensive services. They further felt that innovative means are needed for sharing national resources with these groups.

With these caveats in mind, the telecommunications/services packages developed in this study are designed to address problems within the present service delivery environment, fully realizing the need to adapt current delivery modes in some instances and supplement these modes through telecommunications in others. The focus has been on those services that are most amenable to integrated delivery and at the same time, are capable of delivery through telecommunications in a cost-effective manner. While the services within the packages may not contain any surprises, the innovative aspect is the packaging itself, in which several services can be delivered using similar technology, thus enhancing the potential of integrated service delivery.

A final point is that this report is addressed primarily to the service planners and providers and has therefore attempted to take into consideration as much as possible their specific concerns and research needs. It is hoped that this document achieves two purposes: first, that it demonstrate strongly the feasibility, utility, and effectiveness of telecommunications in various service delivery contexts; and second, that it assist in planning demonstrations of such approaches, especially in terms of evaluating the impact of the projects and ascertaining whether they should be established on a wide-spread and on-going basis.

2.0 PROJECT METHODOLOGY

2.1 Conceptual Approach

The conceptual approach for this study was relatively straightforward in that the underlying question that we have attempted to answer is: "What are the needs for specific social services, and in what ways can telecommunications technology be utilized to meet these needs?" The focus of this question should not be overlooked. We have structured our study around the need for a given service or set of services, how well these services integrate with each other, and what are the possible technologies available. We feel that this "needs/services" approach is more appropriate than the "feasible technology" approach because it tends to deal more directly with the problem at hand and one is not tempted to search for needs simply because there is a technology that appears to work and that might have some useful application.

A further aspect of our approach has been the manner in which we have obtained our information. While it was not possible to perform a comprehensive needs assessment, nor use primary data sources for information regarding current projects, we have placed strong emphasis on the views of the service providers and the service recipients. Their knowledge of telecommunications may, in many instances, be extremely limited; however, their knowledge of the services that they feel should be provided and the problems encountered in providing such services are the very basis upon which the packages are developed and the demonstration design and institutional constraints conceived. Adherence to this approach led us to a study that is weighted heavily towards the services themselves as opposed to the technology, and this is altogether appropriate.

2.2 Development of Service Packages

The specific techniques employed in the determination of service needs consisted of a literature search of the projects utilizing telecommunications currently underway and those that have been conducted in the past, interviews with key people in the service delivery and telecommunications field, direct contact (by telephone) with several of the projects that were felt to prototypical of the types of applications possible, and the utilization of a Telecommunications Users Advisory Committee that was selected to represent the views of the service planner, the service provider, and the ultimate service recipient.

Examining specific projects currently in operation as well as past projects was the major effort of the literature search. The case study method of research was chosen to achieve three goals: (1) to provide a detailed overview of the state of the art; (2) to isolate factors associated with successful and unsuccessful operations; and (3) to provide input for future site-specific planning. Basically, our intent was to produce findings which will be useful in specific planning situations, as opposed to a theoretical planning document.

The following factors were included as much as possible in each case study:

- program objectives
- program methodology or structure

- program content
- size and scope of program
- target population
- time frame
- impact (i.e., who benefited and to what extent)
- replicability (particularly through private sponsorship)
- hardware configuration
- costs (hardware, software, personnel, etc.)
- evaluation studies conducted

The first step in the data collection process was a review of periodicals and other current literature. Medical and educational journals, cable television and communications-related journals, computer journals, and selected general interest periodicals were reviewed, and as a result of this broad selection of sources, community-based projects, as well as the larger, more publicized, Federal demonstration projects were included. This inclusion of smaller projects seemed especially desirable in view of the utilization of cable television, in particular, in small scale "narrowcasting" projects. The review of current literature led to interviews and site visits for key projects. In this way, we were able to enlarge our information to include data not necessarily publicized on each project. Primary documents, such as programming schedules from cable television were also cllected.

One purpose of the Telecommunications Users Advisory Committee's was to generate input as to what services were needed and insti-

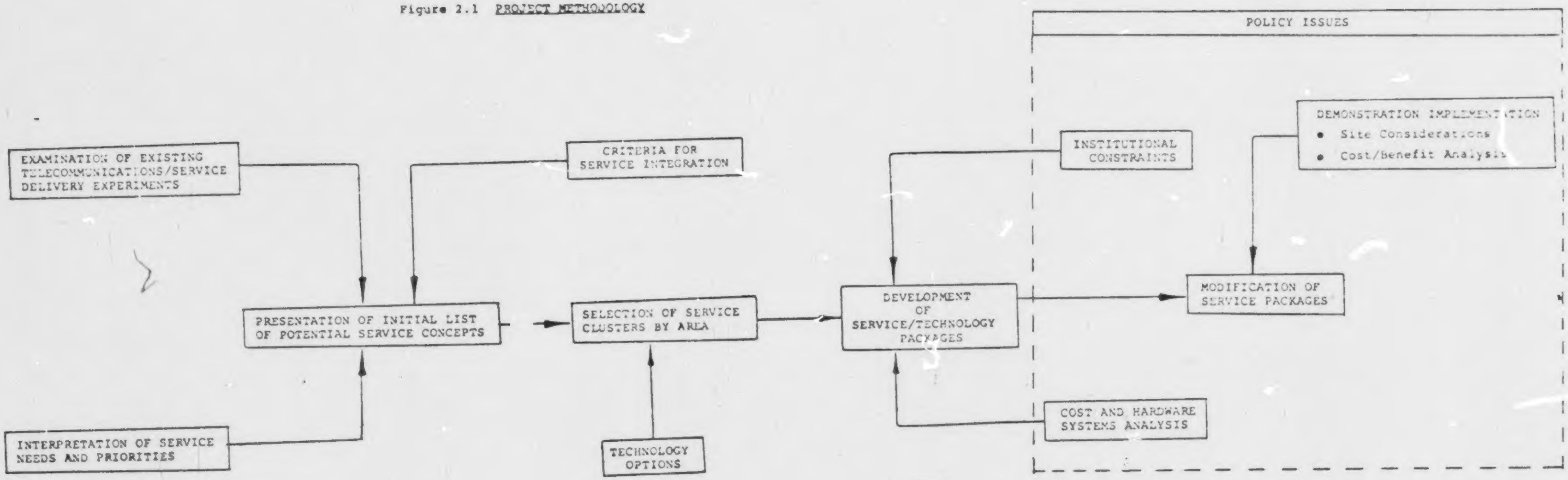
The Telecommunications Users Advisory Committee's purpose was to generate input as to what services were needed and institutionally feasible in their environments. In all, two sessions were held with the Committee and in each session, they were able to focus our attention more closely on the service needs. In the initial session, services were prioritized and ultimately influenced the way in which the services were clustered. In the second session, service packages were examined and services were again refined to those that were most needed and could be delivered most effectively. Out of these techniques we were able to provide both a broad interpretation of service needs and priorities and an identification of those aspects of current experiments that were crucial to the success or failure of the projects.

From this information, an initial list of potential service concepts was developed and criteria for service integration were applied to form clusters of services in the three areas of health, education, and other social services, thus narrowing the number of services to be considered for any given service package. The service clusters were further limited by putting them through a second analytical filter -- that of selecting the most appropriate telecommunications technology options for service mixes. We were then left with a limited universe of technically compatible services that met the criteria for service integration via telecommunications. The next step was to assess the technological options, one opposed to the other for the service clusters, filtering out both those services that did not fit well in the clusters once the technological variable was applied, and those technology options that had limited utility for the service delivery needs we had specified. Through this process we were able to develop our service "packages." A second level of modification of the packages then occurred. This level contained two distinct parts: first was the cost and hardware analysis of the system configurations inherent in the technology suggested by the packages. Since the packages are not site-specific, an attempt has been made to provide a cost and hardware analysis of the systems used in the packages as opposed to narrowly defining costs and equipment for each package. This allows the planner the flexibility to modify the package in terms of size of target populations, technology or system options, and to some degree, actual service content. The weakness of this approach is that no fixed costs for a specific service package can be made at this time but would have to await further specification. Second were the general and the specific institutional constraints that the service "packages" would encounter in their development and in the eventual implementation.

The last analytical step addresses the lack of system specificity and potential constraints in that it discusses some research and demonstration considerations at the site-specific level as well as provides a cost/benefit methodology for determiniation of demonstration performance that makes extensive use of site-specific data. This step is important because it establishes a context in which the service packages can be applied and further suggests the next stage of work for the demonstration design.

Influencing the service packages through out policy issues such as privacy, community control, regulatory policy, and payment structures; and although the exact nature and extent of influence that these issues may have on a given service package cannot yet be measured, the methodology has taken into consideration that these factors are present and may inhibit or enhance the success of the demonstration. Figure 2.1 graphically illustrates the relationships of the various aspects of the project methodology and the structure of this report adheres rather closely to the methodological steps just described. Chapter 3.0 presents the results of the examination of current experiments, while Chapter 4.0 develops the initial list of services into integrated service clusters. Chapter 5.0 contains both a discussion of the technology options and further refines the services into packages based on specific telecommunications systems. Chapter 6.0 suggests the constraints upon the packages and Chapter 7.0 is a detailed cost and hardware analysis of the systems that the packages employ. Chapter 8.0 is the demonstration implementation, containing site-specific package selection considerations and the cost/benefit methodology. Chapter 9.0 is the policy issues mentioned above.

Figure 2.1 PROJECT METHODOLOGY


EXAMINATION OF EXISTING TELECOMMUNICATIONS/SERVICE DELIVERY EXPERIMENTS
INTERPRETATION OF SERVICE NEEDS AND PRIORITIES
CRITERIA FOR SERVICE INTEGRATION
PRESENTATION OF INITIAL LIST OF POTENTIAL SERVICE CONCEPTS
SELECTION OF SERVICE CLUSTERS BY AREA
TECHNOLOGY OPTIONS
DEVELOPMENT OF SERVICE/TECHNOLOGY PACKAGES
INSTITUTIONAL CONSTRAINTS
COST AND HARDWARE SYSTEMS ANALYSIS
POLICY ISSUES
DEMONSTRATION IMPLEMENTATION
• Site Considerations
• Cost/Benefit Analysis
MODIFICATION OF SERVICE PACKAGES

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3.0 A REVIEW OF CURRENT PUBLIC SERVICE/TELECOMMUNICATIONS EXPERIMENTS

Within the last ten to fifteen years, new telecommunications technologies and related computer capabilities have become available and have found widely varying applications in the service institutions of society. Schools, hospitals, and social service agencies have implemented experimental programs using these technologies to enhance communications, to promote resource-sharing between institutions, and to deliver new and innovative services. Experiments have ranged from large-scale Federally-funded programs to local community-oriented projects. The telecommunications-based service delivery programs have had an impact on styles of service delivery: the role of the service providers, the role of the service recipients, relationships between institutions, and attitudes of the service recipients to the institutions and people involved in service delivery. The experiments have encountered many difficulties as well as successes, at times from unexpected cost and technological problems associated with hardware, but more frequently with the pains of adjustment on the human level to new styles of service delivery.

The speed with which telecommunications-based service delivery programs and systems have emerged has created a situation in which many program planners have not had the benefit of knowledge of the experience of others. The purpose of this section is to synthesize some of the threads of the various experiences, so that this information will be available for planning purposes for other groups. At this stage in the development of telecommunications experiments, it is important to promote communications about and between the various people, groups, and institutions involved in integrating these new technologies into the existing networks of service delivery systems.

A review of current experimentation in adapting telecommunications technology to the fields of health, education, and social service delivery reveals a great diversity of program goals and objectives, target populations served, and functions of the technologies. This is hardly surprising when we consider the many different ways telecommunications and information technology have been incorporated into the activities of everyday life. In the service delivery context, the technology has been utilized for resource-sharing between institutions, for professional interaction between service providers, for coordination of geographically separated institutions, to speed the flow of information between service providers and service recipients, to reduce transportation needs, to deliver new and innovative services, to individualize services received, to save costs in service delivery, and for self-expression by various groups in society. Populations served range through all age groups, and from the underprivileged and special-interest groups to social service providers and the medical and educational establishments. The projects themselves stretch over great geographic distances and involve both complex and unique hardware at central locations as well as locally-based sites making creative use of relatively simple hardware such as the telephone.

There is no doubt that telecommunications technology has the potential to change the process of communications between people and institutions. One writer, in discussing medical services, points to a trend in all of the public service applications of the technology:

> Notice that the emphasis is on "reconstruction," not on more of the same. The idea that simply more practitioners, more research, more hospital beds, even more specialized medical technology will generate a viable health care system is being increasingly discarded by the medical community as a time-worn panacea. Instead, what is being called for is a restructuring of existing resources so that these are utilized and distributed in closer correspondence with existing health needs.[1]

We may transpose this statement to the areas of education and social service delivery as well. The important result of this reconstruction of service resources is that more people may be served and more specialized needs may be met, through the more efficient use of resources. Community-based systems with greater outreach potential become more feasible when the resources of many institutions are shared through telecommunications. In addition, the whole television medium changes from being a broadcast medium which caters to mass needs to that of a "narrowcast" medium which may be responsive to local and individual concerns, and which involves participation by community members.

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[1] Konrad Kalba, Communicable Medicine, Alfred P. Sloan Foundation, September, 1971, p. 6-7.

In this study, the purpose of examining this wide range of telecommunications experiments was to identify service possibilities and to gain a preliminary idea of the feasibility of the services, based on past experience. The following overview of experimentation to date will serve to demonstrate the range of services on which data is now available.

3.1 Applications of Telecommunications Technology in Health Care

Some of the most sophisticated telecommunications service delivery systems have been in the area of health care. Telemedicine systems have been developed to serve medical needs of all types, including: consultation, diagnosis, therapy, medical education and continuing medical education for professionals, management of hospital activities, and public health. Most projects involve multiple services, either because the system was designed to deliver these services or because once the system was installed, new service uses evolved.

Telemedicine systems date from 1964, when the Nebraska Psychiatric Institute in Omaha and the Norfolk State Mental Hospital, 112 miles away, were linked together by two-way closed circuit television. This system was designed to serve several functions: staff education, psychiatric consultation, patient visits, remote ward administration, personnel training, and joint research. Other systems employing two-way transmission include Massachusetts General Hospital/Logan Airport/Bedford V.A. Hospital; Mt. Sinai Medical Center/ Wagner Pediatric Clinic; Illinois Department of Mental Health Medical Center Complex/Community Mental Health Program; Case Western Reserve; Bethany/Garfield Community Health Care Network; Lakeview Clinic, Waconia, Minnesota; the Vermont-New Hampshire Medical Interactive Television Network; the Louisiana Hospital Television Network; the University of Kansas Medical Center/ University of Kansas; Georgia Regional Medical Television Network; the Rural Health Associates Network; and the Blue Hill/Deer Isle Telemedicine Project in Maine. The projects mentioned above involve a variety of program objectives. The purpose of the experiment at Massachusetts General Hospital is "to determine whether professional consultations could be facilitated by means of two-way telecommunications circuitry."[1] The Lakeview Clinic project, the Mt. Sinai project, the Rural Health Associates project in Maine, the Case Western Reserve project, the Blue Hill/Deer Isle project, and the Illinois Medical Center Complex project all are designed to provide non-physicians with a means of consulting physicians. The Louisiana Hospital Television Network, the Georgia Regional Medical Television Network, the Vt.-N.H. Interactive Television Network, and the Bethany Brethren Hospital project are all geared toward linking and coordinating the activities of several institutions that provide similar types of health services. The Louisiana Hospital Television Network coordinates the state's mental health activities; the Bethany Brethren project links two community hospitals, three medical clinics, and a drug clinic staffed by ex-addicts; and the Georgia Regional Medical Television Network is primarily concerned with linking institutions for medical education. The Vermont-New Hampshire Interactive Television Network consists of three teaching hospitals, three community hospitals, a vocational technical college, and a state prison; and the services delivered through the system include teleconsultation, conferences and seminars, speech therapy, and educational services to prisoners. This system illustrates the advantages of delivery of an integrated group of services. The services which are currently being delivered are only a few of the projected uses of the system, which is planned eventually to connect 20 hospitals and medical institutions in four New England states.

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[1] *Teleconsultation: A New Health Information Exchange System*, April 1971, p. 3.

Two projects which resemble these in content but differ in technology are the Boston City Hospital Nursing Home Telemedicine program and the Alaskan Satellite Network. The Boston City Hospital project uses nurse practitioners for primary care in nursing homes, with back-up consultation to physicians; however, consultation takes place over the telephone. Planners at Boston City Hospital chose the telephone as the support technology because of its ubiquity, for the physician does not have to be stationed at a two-way television in order to give teleconsultations and elderly patients need not be moved to a television camera. When visual data is needed, the nurse practitioner takes photographs which the physician examines the following day. The Alaskan Satellite Network also uses purely audial communication; the purpose of the project is to determine what services can be delivered using audial links. This system provides patient education, community education on timely health topics, continuing education for health aides, doctors, and nurses, patient visiting, and voice consultations.

A number of hospitals have effectively utilized one-way closed-circuit television: for staff education at the Bethesda Hospital in Cincinnati, Ohio; for medical education at Temple University in Philadelphia; and for patient education at St. Nicholas Hospital in Sheboygan, Wisconsin. The Ohio State University Hospitals have a four-channel cable television system designed exclusively for patient education. A particularly valuable application of one-way television in medical education has been the televising of surgical procedures such as dental and opthalmic operations, which are too minute to be seen by the students under ordinary circumstances. The dental applications have been conducted at the Indiana University School of Dentistry and the University of Alabama School of Dentistry, and opthalmic surgery has been videotape recorded at the University of Connecticut Health Center. These projects provide a valuable example in that the technology is used to full advantage to provide a new service, based upon the strengths of the technology and the need of the students.

Videotapes have been used productively and cost-effectively in a number of different settings. At the Veteran's Administration and St. Elizabeth's Hospitals in Washington, D.C., self-confrontation through videotape has been used successfully with schizophrenics. With the guidance of a therapist, patients were aided in confronting their own physical presence through viewing videotape recordings of themselves. The East Central Missouri Health Center utilized videotape recordings in marital counseling with immediately measurable positive results. In many cases, simply playing a few videotapes of a couple relating to one another created a new level of self-understanding for the couple. Videotape has been used in physical rehabilitation at the Blythedale Children's Hospital in New York, where the progress of the physically handicapped children was recorded and measured. Videotapes were also used for consultation purposes, thus sparing the handicapped child the ordeal of appearing before groups of strange doctors.

Computers are being used increasingly to increase efficiency in hospital management and to speed the flow of information between various branches of the medical center. DIVOTS (Data Input Voice Output Telephone System) in the Youngstown Hospital Association, Youngstown, Ohio, is a computer system that responds by voice to telephoned instructions as a method of speeding the flow of patient information between doctor and laboratory. This network connects physician's offices, nursing stations, and the administrative offices to an IBM System/7 computer, through a push-button telephone system, automatically ordering laboratory tests, and providing the physician with immediate access to test results.

Computerized medical histories have been in relatively wide use since 1966, when physicians and computer programmers at the University of Wisconsin combined their efforts to produce a programmed medical history, with the goal of saving physician time and upgrading the quality of medical history records. In general, patient acceptance of such systems is reported to be good; for some types of medical history-taking, involving discussion of personal physical or mental symptoms, some patients prefer the impersonality of the computer. However, computerization of medical records introduces the issue of confidentiality of information. When the data is collected and organized, making it more accessible, policy decisions must be made concerning who will be given access to the data.

Computers were used at Beth Israel Hospital, Boston, Massachusetts, to aid in chronic disease management. A paraprofessional health worker, interacting with the computer, administered check-ups of the patients. The goal of the project was to reduce physician time while maintaining the quality of care. The program ended when the protocols used by the computers became increasingly refined to the point that they were simple enough to be administered manually by the health worker, a cheaper procedure than using a computer. These results suggest that the computer could be valuable in the development and refinement of medical protocols.

Computers have also been suggested as a means of gathering and organizing medical data. The National Library of Medicine established MEDLARS-MEDLINE, a data bank of medical journal literature, to meet this need. Over 100 institutions have access to MEDLARS-MEDLINE, and over 2,000 journals are indexed in the data bank.

In examining these various telemedicine projects, certain characteristics may be seen to occur in many projects. First, and most important, is the experimental nature of the projects. These telemedicine projects were introduced by certain innovative persons in each medical institution, and these individuals faced the task of educating the health care providers in the use of the new technology. Because the field is so new, those who adopt a telemedicine program have to create their own training programs and have to learn how to implement each step of the program. There is a lack of knowledge in the field; and knowledge which has been gained is not organized and accessible to others. Yet, planners have begun to suggest that in the future, medical education and education in the technologies of modern medicine must take place side by side so that the health worker of the future will be as much at home with the technology as he or she is with medical procedures.

Resistance in the medical field to the new technologies comes from the natural fear of change and also because the roles of the service providers are affected by the new systems. Differing results in terms of the role of the non-physician have been reported by various projects. At the Wagner Clinic, the nurse practitioners began to be able to handle more patient cases with the advent of the telemedicine system. They felt also that the system was an effective means of increasing their medical skills, because their participation in telediagnosis increased their diagnostic knowledge. In contrast, a project connecting neighborhood clinics to the Cambridge City Hospital in Cambridge, Mass., now discontinued, resulted in the nurses handling fewer patient cases; with the physician available through teleconsultation, nurses assumed a more passive role. These issues must be addressed in future demonstrations, and the impact of strong training programs in telemedicine for the medical personnel in easing the resistance to the technology can therefore be determined.

Cost has been found to be a barrier in many projects for the technology tends to be too expensive to be implemented without outside financial assistance. An exception to this problem is the Vermont-New Hampshire Interactive Television Network, which is now expected to become the first self-supporting two-way television system. Member institutions have found the services of the system to be sufficiently valuable and cost-effective that they are willing in the future to pay a fee for participation in the network, which is expected to cover the costs of the system. Experiments using more modest hardware have been more easily cost-effective. For example, at the Bethesda Hospital in Cincinnati, staff training through videotape recorded instruction shown on the closed-circuit television system brought almost immediate recognizable cost benefits, measured in savings in instructor time. The basis for the cost-effectiveness of projects such as this is that a function which was formerly performed live is now performed on tape, so that the two methods can be easily compared in terms of expense. Evaluation of the quality of instruction delivered live or on tape is a more complex matter; the impersonality is generally considered to be a debit; however, the standardized instruction provides a means for control of quality. Many planners do not look to telemedicine as a means of replacing services which are now delivered in person, but rather as a means of increasing the quality of health care training and delivery through performing new services.

Another issue which recurs in the telemedicine projects examined is for health providers to identify areas of need which could be met by telecommunications. Technological innovation must be responsive to a real need. The success or failure of telemedicine planners to gain this information from health care professionals will probably determine the success or failure of telemedicine. Health professionals must be educated in terms of the technology in order for this to occur, and the future of telemedicine will depend on the creation of new, imaginative ways to deliver health services through telecommunications technology.

New health care distribution systems, which can provide more comprehensive health services for more people, must extend the service capacity of individual physicians both geographically and in terms of the number of patients each can serve. It is widely accepted that one key to such systems lies in the more effective use of physician extenders. Communications systems should be considered as tools, and their utility will depend upon the organizational structure of the health care systems into which they are incorporated, and the appropriateness of the links created.

3.2 Applications of Telecommunications Technology in Education

Television has been in use as an instructional medium for more than a generation and has penetrated most educational systems in the U.S. Since 1960, educators have experimented with computers, radio, telephone, and more recently, two-way interactive television. Yet, while the education field has seen many innovations in classroom and out-of-classroom instruction, many of these innovations have proven to be disappointing, and now more than ever, educators are seeking ways to use telecommunications technologies effectively to improve the quality and extent of educational services. Addressing themselves to the use of instructional television in primary and secondary education, Harold J. Barnett and Arthur T. Denzau said in a 1971 Washington University study, "In the United States generally, television is now playing a trivial role in school instruction. In the Nation as a whole it probably occupies only a few of the 1,000 or so school instruction hours with which each of our children are provided each year. The Nation spends an average of about $800 per child for its school population of more than 50 million pupils. But not more than several dollars of the annual outlay per child is for television or sound film instruction. Thus, the seeming paradox; an alleged great innovation for school instruction which, however, school personnel do not use." Barnett and Denzau suggest two possible reasons for this situation; first, resistance of the existing educational structure, and second, the immature state of development of instructional television itself.

An interdisciplinary team of communications specialists at Stanford University have identified two overriding issues in American education to which they believe that telecommunications can and must play a central role. These are extension of education beyond the physical walls of the traditional institutions of education and making educational available to all persons, at all times throughout their lives. These two issues are addressed in numerous ways in current experiments in using telecommunications in education. Many of the major projects have as their goal the sharing of resources to increase educational opportunities for students. Other projects deal with delivering new and different educational services to meet individual and specialized learning needs. A third category of projects is concerned with extending educational services to settings where they have not been available in the past--in the home, in industry, in prisons, and in community centers. Extending these services to new sites has the function of allowing new target populations to receive services and of reducing transportation needs of others, an important issue in recent times. A fourth type of telecommunication application which has emerged is the learning of "visual literacy," or the knowledge of how to use visual media as a tool for expression, just as we now use the written word.

The prototypical experiment in using telecommunications to increase course offerings by sharing resources between institutions is the Hagerstown, Maryland closed-circuit television system. This system has been operating since 1956, allowing students to take a special comprehensive series of science courses that would have otherwise been unavailable to them, to have special television instruction by experts in art and music, to take language courses beginning in third grade, and to take advanced courses in calculus and analytics in high school. The Indiana Higher Education Telecommunications System serves much the same function on the university level; students at Indiana University, Ball State, Purdue, Indiana State University, Vincennes University, and the Indiana

Vocational Technical College may take courses emanating from any of the institutions. State-wide professional continuing education programs have been developed for farmers, lawyers, dentists, pharmacists, veterinarians, accountants, nurses, chemists, speech therapists, clergy, nursing home administrators, and the university physical plant personnel. Continuing medical education for physicians is provided through the Medical Education Resources Program (MERP) of the Indiana University School of Medicine, with courses scheduled at 19 hospitals throughout the state and occasional presentation of state-wide medical symposia and conferences. In Harrisburg, Pennsylvania, 17 schools having closed circuit television systems have been interconnected by cable, making the facilities and course offerings of each school available to all.

A dial-access system, referred to as Information Retrieval Television, in five schools in Ottawa, Ontario, Canada, has served to make the resources of a large audio-visual library instantly available to teachers with a minimum of class disruption. This system was developed to give flexibility to teachers in using instructional media, in response to the complaint that scheduling for instructional programming was too rigid. The system has been successful in that it has been widely used and gained a fairly high level of acceptance from teachers and students; however, costs were judged to be too high. The system suffered from a problem common to many current educational television projects -- the lack of high quality software.

The Educational Telephone Network, developed by the University of Wisconsin is a project for resource-sharing between institutions. Fifty courthouses, 15 University of Wisconsin campuses and centers, and 56 hospitals throughout the state are connected in a huge party line which makes conferencing possible between all the installations. Educational programs presented on ETN usually consist of live or taped lectures followed by question-and-answer periods. Each questioner is heard over the entire network. The program was originally developed for continuing medical education and has expanded to include programs on law, pharmacy staff training and development, social work, library science, nursing, 4H, engineering and music. College credit courses have included home economics, library science, veterinarian sciences, physics, sociology and English.

Chief among innovations in actual educational services are the computer-assisted-instruction programs. Computer-assisted-instruction was first developed at Stanford University and even today has largely proven its usefulness through drill-and-practice instruction. Applications of the drill-and-practice capability have been made in mathematics, medical education (at the Massachusetts General Hospital, Boston, Massachusetts), and language instruction. In computer-assisted-instruction, too, the need exists for extensive software development. The University of Illinois PLATO system is another computer-assisted-instruction system which has expanded the areas of computer-based studies to include electrical engineering, geometry, biology, nursing, library science, pharmacology, chemistry, algebra, computer programming, and foreign languages. Cost has tended to be a major factor in acceptance of computer-assisted-instruction. In addition to the start-up costs of terminal equipment, computer time must be purchased. Most educators agree that costs must be brought down before computer-assisted-instruction will be practical for most educational settings.

The TICCIT (time-shared, interactive, computer-controlled, information television) system developed by the MITRE Corporation is an interesting variation on computer-assisted-instruction. It is designed to provide users with a low-cost home terminal, utilizing a standard television receiver as a display. A frame-grabbing technique, which allows many users to share a single transmission channel, makes this possible. The system has been demonstrated in Reston, Virginia, and is now being implemented in Stockton, California. This system, however, is relatively costly, and its success will depend upon development of services which the consumer will be willing to pay to receive in the home.

A group of experiments in using educational television in continuing education, with the specific goal of reducing transportation needs, involves a linkage between a university and an industrial site. The prototype system is the TAGER system at Southern Methodist University. A number of firms within a 60 mile radius of S.M.U. were connected to permit employees to receive engineering instruction without leaving the industrial site. The University of Florida, Stanford University, the University of Michigan, the University of Southern California, Purdue University, the University of Minnesota, and the University of Arizona initiated similar programs, which proved to be cost-effective because of the savings in employee travel time. A "talkback" capability to enable students to ask questions is achieved through the use of a telephone line. Students have rated this educational system as comparable to and sometimes superior to conventional methods.

The Open University concept, pioneered in Great Britain, provides entire degree-granting programs through a combination of television and radio lectures and written materials to be employed in the home. Periodic visits to regional centers are also included. The Open University is geared to the non-traditional students, particularly those confined to the home, such as housewives, the handicapped, the elderly, and those adults who are unable to take advantage of the conventional channels of instruction. The University of Nebraska SUN project was created on the British model and is presently demonstrating some of the concepts and program applications that would be found in a full-scale telecommunications open university system. Courses are presented in six modules; a television program module, an audio cassette module, a textual module, an instruction kit module, and a newspaper lesson module. These modules are developed by a course team consisting of educational curriculum developers and media experts, to assure both high academic quality and appropriate media utilization. The program objectives of the SUN project are to employ educational technology systematically in a non-traditional delivery system and to design high quality materials which may be used in other programs.

A special population that is particularly amenable to delivery of educational services by telecommunications is the prison population, which is socially isolated and in needs educational and vocational instruction. Prisoners at the Illinois State Penetentiary have received college credit courses over cable television since 1965. In Chillocothe, Ohio, a program was developed in which prisoners produced their own television programs for the community. Prisoners at the Windsor State Prison in Windsor, Vermont, now receive vocational instruction from the Claremont Vocational Technical College in Claremont, New Hampshire, through the Vermont-New Hampshire Interactive Television Network.

Projects involving use of telecommunications media by students have been successful for ages as low as nine, ten, and eleven years old in the Children's Video Theatre project at the University of Massachusetts School of Education. The children gain technical expertise and language skills (from script writing and narrating programs) as well as gaining information on the subject matter of individual programs. An additional benefit of the program is the opportunity for expression and communication given to children of diverse backgrounds, for the Children's Video Theatre project involves a group of racially-mixed children from the inner city and a group of white suburban children.

The above projects are only a brief representation of the field of telecommunications in education as it now exists. Probably what has been considered to be the intrinsically personal nature of instruction has tended to inhibit experimentation with televised instruction, although recent media successes such as Sesame Street and The Electric Company may alleviate fears of television resulting in inferior instruction. Living in the age of "the medium is the message," it is difficult to ignore the potential of visual media to enrich the educational experience. For this reason, many experiments combining television, videotape and computer technology are now being incorporated into the conventional classroom. Colleges and universities have been encouraged by rising costs, rising numbers of students, and the shortage of professors, to turn to methods which will allow a single professor's time to be used to optimal advantage, sometime going to the extent of televising lectures to dorm rooms as well as to classrooms. The University of Illinois has one such project, in which 5400 dorm rooms will receive university lectures through a cable system installed by the local cable company. Similarly, cost savings is the motivation for the industries who have turned to cable or closed-circuit television to provide advanced education for their employees at the industrial site.

Many of the current telecommunications educational projects suggest that the role of the teacher may be substantially changed in the future through the use of the technology. First, computer management of routine tasks can free the teacher for more personalized instruction. Testing and grading may be delineated to the computer in the future, as well as routinized teaching tasks such as drill-and-practice sessions for which the computer may be easily programmed. Secondly, the role of the teacher may change into one of resource manager. Just as education increasingly consists of learning how to locate information, the teacher may become one who teaches how to locate and utilize educational resources.

The contention of some educators is that television systems may be more readily applied to some subjects of study than to others. For example, the Oregon State University program which cablecasts university courses to off-campus homes and classrooms, dormitories, and other buildings has been very successful. The cable lectures are combined with face-to-face "recitation" sessions on campus. A similar program at the University of Oregon has been less successful, and the University of Oregon faculty attributes the difference to its liberal arts orientation as opposed to the science and engineering orientation of Oregon State. Clearly, more standardized material is better suited to pre-recording.

Just as the advent of telecommunications technology in general has the potential for changing our concept of institutionalized meeting places, so the institutions of education could potentially change drastically in organizational structure through the implementation of educational telecommunications systems. The conventional classroom, or even the home, could become a resource center connecting the individual to a variety of people and resources throughout the country and the world.

3.3 Applications of Telecommunications Technology in Social Service Delivery

The field of social service delivery through telecommunications is one which still remains largely to be explored. The most widespread group of what one might term social service applications to date has consisted of public interest programming on cable television, addressing issues of interest to groups within the community and offering information of general usefulness on services and communities affairs. Another group of applications is geared toward management information systems and involves organizing of social service data for greater accessibility by service recipients. In addition, there are services for special groups within the community who are particularly in need of social service delivery or who are isolated from conventional delivery mechanisms.

A major project designed to enhance service referrals is located at the Model Cities Community Information Center in Philadelphia. This information dissemination system offers information and referral to citizens on subjects ranging from housing problems, public assistance, employment and consumer protection to educational needs and governmental problems. This information is stored in a computer data bank which is accessed by referral specialists. The citizen describes his or her service need, the information is accessed from the computer, and the referral specialist then contacts the suggested agency, and a three-way telephone conversation ensues between the client, agency caseworker, and referral specialist. If a client appointment is made, the referral specialist contacts the client three days after the appointment to see whether the service has begun, whether the problem has been solved, and how satisfactory the service was. This project was designed to solve the problem of under-utilization of available services by community members. Another benefit to be gained is increased rationalization of the roles of various agencies.

A similar project was undertaken by the Information Systems Center in Cincinnati, Ohio, to use a computerized information system as an instrument to promote services integration in human services organizations. Information on clients, the services they receive, and the referrals that are made to the agencies serving the clients, and the volume of services provided by the agencies were included. The goal of the system is to bring together all the information that the agencies have normally used so that for planning purposes one could determine what agencies provide which services. Follow-up to determine whether clients had received appropriate services is also a function of this system. The costs associated with the system were determined to be too great, however, and the project was continued in manual form after Federal funding ended.

A system in North Carolina involves teleprocessing in public assistance administration. The system is used to immediately delay the case status of a public assistance application, to prepare MEDICAID stickers, to determine MEDICAID eligibility and to issue monthly labels for MEDICAID vendors. The amount of saving of clerical time appears to guarantee the cost-effectiveness of the system.

Increasing citizen participation in government is another service suggested for delivery through telecommunications technology. A major demonstration in this area is Project MINERVA, conducted by the Center for Policy Research in New York. The electronic town meeting is project MINERVA's contribution to increasing participatory democracy. The purpose of the electronic town meeting is to use cable television and/or radio for broadcasting town meetings, with telephones as well as roving television camera crews to obtain citizens feedback. An experimental town meeting was conducted in a housing complex, and four residents of the complex spoke on a half-hour FM radio program about the problem of tenant security. Citizens in the complex could videotape responses to be shown over public access cable television. Post card ballots were distributed to each apartment in the complex asking that the tenant vote on one of the four solutions to the security problem proposed by the speakers. This type of project is at present largely in the planning stages and is possibly dependent upon the implementation of costly polling equipment in individual homes.

Less interactive projects in citizen participation have consisted of programming of local events on cable television, so that citizens may be more closely aware of the proceedings of local government.

Cable television and videotape can also provide a means for groups or individuals to express opinions to the community. Various projects in public access have resulted in a small but growing group of citizens who can effectively use the videotape medium to communicate with their communities. In some communities, neighborhood television centers have been organized, where community members are taught how to use equipment and encouraged to produce programs relevant to the community. The Downtown Community Television Center in Chinatown, New York, was founded "to provide needed services for an exploited, media starved community." Bridgeport, Connecticut's Community Video Center has been used to spread knowledge of local problems and to tape story hours and book talks from the local public library. The Washington Community Video Center makes programs for specific purposes -- "to force the city government to clean up the city, to expose absentee landlord's housing code violations, to educate the community about land speculation and other community problems, and to inform residents about vital facts relating to their survival in the city."

The League of Women Voters and the Citizen's Advisory Committee on Environmental Quality have produced a series of programs which will be presented on 120 cable systems on "The Use of Land: Some Propositions for Civil Debate." The objective of this series is to stimulate a national debate at the local level on questions of land use. Representatives of varying viewpoints are invited to attend showings to chapters on the league of Women Voters and to participate in discussions.

Special target populations for social and rehabilitative services include the handicapped, the elderly, youth, public assistance recipients, and minorities. Telecommunications experiments to meet the need and reduce the isolation of these groups are just beginning. The elderly residents of the Gaylord-White housing project in East Harlem, New York, have recently been connected to the Mt. Sinai medical center by cable, and plans are in progress to provide local origination facilities for these people right in the housing project. The premise of the experiment is that the social isolation of the elderly is a contributing factor to their health problems and that by providing a means of involving the elderly in communications activities, their social isolation will be partially alleviated.

Programs for the handicapped include a test program in Overland, Kansas, where two home-confined handicapped children had terminals installed at their bedside for special instruction;

a program sponsored by the Rehabilitation Research and Training Center in Washington, D.C. to train handicapped home-confined persons to be computer programmers, keypunch operators, microfilm equipment operators, and microfilm editors, all jobs which may be performed in the home through telecommunications links; and a project in programming for the deaf by the Deafness Research and Training Center of New York University School of Education. The purpose of this project was to increase availability of programs for the deaf. Cooperatives have been formed in Reading, Pa., and Orlando, Fla., of deaf and non-deaf people for the purpose of preparing programming for the deaf. In addition, the Deafness Research and Training Center worked closely with a broadcast program of general interest to implement an oval insert with signing for the deaf.

Special services for youth have largely been confined to programs of interest to youth on community activities. One program in the area of career education is "Career Time Reston," Reston, Virginia, in which residents appear and discuss their occupations. A program called "Cablevision Job Line" in Colorado Springs is a "classified ads of the air," which shows job listings, as well as information on how to look for a job.

For minorities, cable television offers the opportunity for cultural expression. Programs for non-English speakers are more feasible over cable television than on broadcast television, and several Spanish programs have been produced in the Southwest. There are presently several cable franchises and cable companies owned or controlled by minority interests and these companies provide the opportunity for programming geared for and about minority groups.

3.4 Implications of Current Experimentation

This look at the range of recent experiments in service delivery using telecommunications technology suggests many services concepts and target populations. Particularly in a new field, it is most important to plan from the basis of whatever data is available on possible strengths and weaknesses of the type of service system being considered. In actual implementation of a service delivery system, it will be necessary to study in detail, previous experiments containing as many relevant factors as can be determined. What this examination of current experimentation has shown is that successful telecommunications service delivery applications have been demonstrated in a wide variety of situations and have served an equally wide variety of needs. Of significant importance is the discovery that "human factors," such as professional and community acceptance and adjustment of work and life styles are often more critical to success than the sophistication or complete appropriateness of the telecommunications technology employed.

Finally, no experiment is likely to succeed without a clear understanding of the needs associated with the services to be delivered and the establishment of clear objectives to meet these needs. In the next chapter, the service concepts suggested by this review of experiments are discussed more thoroughly with the end result being the development of clusters of services based on service integration criteria that have been deemed most appropriate for consideration as components of eventual telecommunications/service delivery packages.

4.0 DEVELOPMENT OF INTEGRATED SERVICE CLUSTERS

4.1 Overview

As stated in the introduction of this report, the overall purpose of the planning study was to explore ways in which communications technology may be used to enhance and extend delivery of public services and to create innovative and cost-effective means of service delivery. The results presented in this report comprise the basis for planning of a demonstration which integrates a number of alternative delivery systems with several public service concepts. The initial task in the study was to identify suitable areas of need and then to isolate groups of services and service concepts.

A service is an interplay of a resource and a recipient--it can be a human resource or an information resource. In a telecommunications-based service delivery system, scarce resources are utilized in a manner which is more efficient, less costly, or increases the sphere of influence of the resource. In order to effectively plan how to use telecommunications in service delivery, one must pinpoint the scarcity of resources and then design the system to optimize efficient use of that resource. In the area of health care, physician time is a scarce resource. In education, as well, professional time is at a premium. Scarcity of professional time affects health care delivery in that the less advantaged groups or those with less urgent need do not receive adequate health care services, or in some cases, do not receive health care at all. Scarcity of professional time affects education in that education is delivered on the group level when at times it should be focused on individual needs. Analysis of the nature of service delivery problems such as these will point to the most effective ways to use the technology--in the areas of greatest need. Telecommunications should be used in service delivery to maximize use of professional time and to maximize use of materials and information relating to the service.

The service concepts discussed in this section have been developed from several different sources. First, other relevant studies on telecommunications and service delivery were examined. The goal of this study has been to build upon the previous work in the field and to expand upon such areas as cost-benefit analysis of telecommunications-based service delivery systems, institutional constraints involved in implementing such systems, and demonstration implementation considerations. For this reason, service concepts outlined in previous significant planning documents in the field were reviewed and incorporated.[1] A second source of ideas for service concepts was demonstrations which are now being carried on in the field, ranging from local community-based projects to major Federally-funded demonstrations. The literature search, described in Section 3.0, was conducted to study current applications and to identify trends in experimentation and common factors associated with success and failures of these experiments.

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[1] For example, see Testing the Applicability of Existing Telecommunication Technology in the Administration and Delivery of Social Services, Mitre Corp., April 12, 1973, and Communications Technology for Urban Improvement, Committee on Telecommunications, National Academy of Engineering, June, 1971.

A series of "brainstorming" sessions held at Abt Associates and at the National Education Association, involving Abt Associates senior social scientists and service providers in relevant fields, served as a third source of material for service concepts, in this case focussing on new and untried ideas for telecommunications technology. Educators, health providers, and other social service providers who participated were able to express their concerns about needs and priorities in their fields. The recurrent theme expressed by participants was that there are many applications which have been conceptualized but not executed, and solid execution of these ideas is a higher priority than the generation of new ideas simply for the sake of novelty. The concept of planning from the basis of needs rather than promoting futuristic uses of technology was reinforced by these sessions. The service concepts which emerged from these sessions have been incorporated into the initial list of services, although in many cases these services would be less likely to be demonstrated in the near future on the basis of technological and/or financial infeasibility.

A fourth input to the generation of service concepts was the areas of concern originally stated by the Department of Health, Education, and Welfare for the study. The stated purpose of the study was to:

> demonstrate appropriate roles for modern communications technology in providing needed community information services to and among individuals, more relevant communications between individuals and government, and more effective delivery systems for health, education and social services.

This statement has to some extent provided a yardstick against which certain service concepts have been measured to establish their suitability for this study.

The Cable Report to the President, by the Cabinet Committee on Cable Communications was examined as a fifth source of service concepts. The service areas of high priority and suitability for delivery through cable and related technologies which are delineated in this report were also incorporated into the initial list of service concepts. Particular consideration has been given throughout this study to the principle enunciated in the Cabinet report of protection of personal privacy in all innovative uses of cable technology. As the report states:

> We have proposed a Federally-supported program to demonstrate innovative public service uses of cable technology and to identify more precisely the technical and legal safeguards necessary to protect personal privacy in the use of cable.

This study constitutes the first step in the suggested demonstration. The issue of personal privacy is addressed in Chapter 9.0.

4.2 Service Concepts

The following list of service concepts has been organized in terms of the overall classifications of health, education, and other social services. It will be important to note, however, that these classifications are not conceptually distinct, for certain services crosscut the given categories. The category of health services has been used here to include primary health care, health education, and hospital administration. Education services include those delivered in the classroom as well as in non-traditional settings. The category of other social services has been used here to include rehabilitative services, public assistance services, services for special groups such as the handicapped and the elderly, legal services, and services relating to increasing the participation of citizens in government.

The service list is as follows:

Health Services

1. Public health information to the community
2. Teleconsultation
3. Nutrition information
4. Prenatal and infant care
5. Telemedicine applications using non-physicians
6. Speech therapy via telecommunications
7. Testing of sight and hearing
8. Videotape of rehabilitative process for treatment and records
9. Patient monitoring
10. Computerized patient history
11. Computer data bank for medical information
12. Video medical library
13. Emergency medical network, involving fire, police, ambulances
14. Teleconsultation to prisons
15. Patient visiting via telecommunications
16. Administrative staff interaction
17. Recording and transmitting of medical procedures for health students
18. Patient entertainment via telecommunications

19. Pharmacy services using telecommunications
20. Psychiatric remote diagnosis
21. Teletherapy for mental patients
22. Computerized total hospital activities
23. Video grand rounds
24. Seminars via telecommunications
25. Patient education
26. Continuing education for medical professionals
27. Drug education
28. Videotapes for professional self-assessment
29. Video display of minute surgical activities such as dental and opthalmic procedures
30. Recording of psychiatric interviews for later group diagnosis
31. CAI for medical education

Education Services

1. Adult education
2. High school equivalency courses
3. College course work offered in conjunction with particular universities
4. Career education
5. Early childhood development
6. Resource-sharing among schools
7. Tutorial services
8. Open university
9. CAI for individualized instruction
10. Videotaping of children in educational setting for later viewing by parent and teacher
11. Education programs for drop-outs in community centers
12. Courses for those confined to the home: housewives, handicapped, elderly

13. Programs for the non-English speaking
14. Student produced programs
15. Classroom self-paced learning

Other Social Services

1. Determination of eligibility
2. Repetitive learning for handicapped or retarded
3. Maintaining and updating records
4. Administrative coordination using telecommunications group conferencing
5. Decentralized social service centers
6. Hotlines for referral and counseling
7. Twenty-four hour service centers
8. Crisis intervention
9. Client involvement in social service decision-making
10. Coordination of localities, states and regions for planning
11. Social service information to general public
12. Reduced social isolation of the elderly
13. Social service information for the elderly
14. Rehabilitative services for the handicapped
15. Employment referrals and information
16. Counseling services
17. Family planning
18. Youth development and delinquency prevention
19. Specific service referral from neighborhood centers
20. Neighborhood information
21. Centralized referral from home inquiry
22. Cultural access and expression

23. Public affairs information
24. Electronic town hall
25. Electronic Soapbox
26. Citizen referenda
27. Video literacy workshops
28. Community video center
29. Community outreach
30. Information on rights and anti-discriminatory procedures
31. Information dissemination to welfare recipients
32. General counseling for community residents
33. Cultural programming for the handicapped
34. "Life-coping" skills
35. Vocational training

In order to shape this diverse group of services into a manageable list from which to choose, it was necessary to examine each major category of services, to define the services in terms of target population, institutional linkages and task to be performed; and to determine from selection criteria based on this information, clusters of services which may be analyzed as a service system. It then became possible to consider the range of suitable technologies which might be used in delivery of the services. (See Chapter 5.0) In many cases, a service may be delivered by several types of telecommunications technology with ascending steps of technological complexity.

4.2.1 Health Service Concepts

Health-related services may be delivered to a variety of groups, such as the community at large, the health student, the patient, the health professional (physician and non-physician), and the health administrator. Medical services to be delivered to the community at large are simply delineated; they involve dissemination of information of general interest, such as on nutrition, drugs, and public health services. This information, which is of general interest by definition, would probably be disseminated on a mass basis; one-way cable television would clearly provide one means of delivering this type of information. It might also be disseminated on a user-specific basis, however, as in the telephone call for recorded health information service, or through some two-way television mode. Sites which might be linked in delivery of these community health services are homes (including apartment buildings and housing projects), community centers (defined as any place in the community where people congregate), and institutions related to health care education and provision, such as government public health offices, local clinics and hospitals.

Services which may enhance professional and paraprofessional medical training involve primarily recording and transmitting of hospital activities to the student. Procedures from grand rounds to surgery may be televised in real time to the students (thus avoiding the distracting presence of the students throughout a hospital) and may be stored for future showings. An additional benefit which is gained from the ability to store video information is that of playback for self-assessment. The person performing a task can review his or her own performance afterwards and may even be reviewed by other students or colleagues, although it is hypothesized that health professionals would not want to add this level of professional accountability. A special function of the ability to televise medical procedures is that procedures which are difficult to see, particularly opthalmic and dental surgery, may be magnified for video presentation to the students. Several schools have used the technology in this manner very successfully. Computer-assisted instruction may also be applied in medical education. Institutional links involved in these student-oriented services would be between hospitals, medical schools, colleges and universities, and outlying health facilities.

Services for patients are defined as those which the patient could receive in addition to primary medical treatment. Patient education is the most important and often-discussed aspect of patient services. Patient education may take place in the hospital, in preparation for surgery or other treatments, or in preparation for return home. In addition, it is suggested that neighborhood clinics may become health education centers, as patients may receive instruction in areas such as prenatal and post-natal care. Instruction may be formal, with patients coming to the health clinic for a structured course, or it may be informal, with videotapes on medical subjects available to patients as they wait to see the nurse or doctor on some other matter. Patient services may also include entertainment for hospital patients and convalescent patients, as well as patient visiting in situations which preclude normal face-to-face visits. Institutions involved in these patient services are the hospital and outlying health facilities, since by definition the target population is people who are already patients.

By far the greatest number of services which may be delivered using telecommunications involve the health care professional, to expand his or her usefulness through enhancing communications between the institutions which deliver health services. The health care professionals include physicians, nurses and nurse practitioners, physician assistants, Medexes, and all types of therapists and other allied health professionals. The communications between these professionals will take the form of consultation from one health professional to a more highly qualified or knowledgeable health professional. While the most obvious example of teleconsultation involves a non-physician consulting a physician, the concept of teleconsultation also applies to physicians who consult a specialist and physicians even of the same specialty sharing opinions for group diagnosis. The institutions involved in teleconsultation are the medical center, or any place with a greater concentration of health resources, and any outlying facilities where health services are delivered but where resources are less available, such as neighborhood clinics, nursing homes, rural hospitals and clinics, community hospitals and clinics in poor areas, ambulances, and educational and industrial sites.

Other services for the health professional are continuing education services. Teleconsultation in itself has been found to be an important source of continuing education for the health professional, who is given this opportunity to deal with a specialist in the area being treated. In addition, the capability of recording medical procedures suggests educational applications for the continuing education of the health professional, as well as for the student. The ability for self-assessment through videotape recording has already been noted.

Televised seminars between health professionals are also possible using communications technology. This increased opportunity for interaction among actors in the health field is another educational opportunity made possible through telecommunications. The continuing education programs for health professionals could be carried on in the hospital or other health facility, the universities, and in the home.

The videotape recording capability has specific applications in medical and psychiatric treatment. The visual record of a psychiatric condition or of a physical disability will greatly exceed any written record in accuracy and will provide a basis for consultation of expert opinion and monitoring of progress. The use of videotape recording in psychiatric counseling has been found to be valuable as patients are given a chance to see themselves as others see them. This service does not necessarily involve any institutional linkage; it may be a self-contained activity at any health care facility, or it may be used by health care institutions dealing with a common problem or group of patients. Advanced technology which is now being developed for telemetry (monitoring of vital functions), notably for the space programs, may also be used to monitor patient condition, providing more accurate means of evaluating the patient's progress and a means of quick alert to danger signals.

Gathering and organizing of medical information is another area in which telecommunications may play an important role. Information management systems suggest a means of organizing this data, which can be diverse and detailed, and rendering it more accessible than it is through textbooks. A computer data bank containing information on all diseases, particularly rare diseases and their symptoms and cures has been suggested for the use of health professionals in diagnosis and treatment. This service is designed to help the physician in the huge task of keeping abreast of new developments in medical science. Thus, it also serves as a continuing education function for health professionals. Video records might also be used in conjunction with this computer data bank. A variation on this service idea would be a bank of information that would be useful to, and accessible by, the layperson. A data bank of medical journal literature is already available (MEDLARS, MEDLINE). Institutions which would be involved in information management systems for medical information are computer facilities, colleges and universities, medical centers, and medical schools.

Hospital administrators are the fifth target population for services. Computerization of all hospital activities is a major service which might be delivered to them through telecommunications, to increase efficiency of service provision in the hospital. In addition, opportunities are afforded for staff training and staff interaction, as people are able to have contact through the communications technology.

4.2.2 Education Service Concepts

In the area of education, the services do not vary greatly in terms of the task to be performed; rather, services are distinguished by the means of delivery and group to be served. In general, the goal of these services is to offer educational opportunities to currently underserved groups. In some cases, a group is underserved because it is an isolated group. Therefore, increasing accesssiblity of instructional services, particularly in making such services available in the home, will serve the need of this group, which includes housewives, preschoolers, the elderly, and the handicapped and home-confined. This group is physically isolated from receiving educational services. Another group's isolation might be described as based on social and economic factors, such as lack of education or vocational training. This group also includes non-English speakers, A third group is composed of those with special learning needs: the particularly bright student as well as the student with learning disabilities. Telecommunications technologies could aid each of these groups through the capability of individualized instruction, deliverable in settings outside of the conventional classroom.

The "non-traditional student" includes those people mentioned above who have not in the past had access to educational services. The concept of the Open University is geared toward such people, because of the increased flexibility of an educational institution which is not contained within four walls. Open University applications may include television and radio lectures combined with home study and periodic visits to regional centers. For individuals who wish to obtain degrees through such programs, arrangements for testing and accreditation must be made. The all-television school in community centers or in the home is designed for the individual who does not want to or is unable to relate to the conventional classroom environment. Programs for the handicapped and home-confined could be developed for their special needs as a learning group. Institutions involved could be universities, public school systems, and radio and television companies.

Non-English speaking populations need special educational services in the conventional classroom setting as well as in non-traditional settings, such as community centers. In schools where teachers are not bilingual, bilingual materials could be prepared for the use of the non-English speaking students. Bilingual instruction, especially in areas such as high school equivalency and vocational instruction, may also be given in community centers and in the home, either through pre-packaged educational materials or by real-time transmission.

Socially and economically deprived members of the community, particularly recipients of public assistance, also comprise a suitable population for high school equivalency and vocational training courses, delivered in the home or in the community centers.

Telecommunications technology can provide the classroom teacher with a tool to promote individualized instruction to more adequately meet the individual needs of the students. Use of educational technology should free the teacher for more individual instruction, giving students the opportunity to follow individual study programs. Computer-assisted-instruction is aimed at this goal, as students interact with the computer at their own pace, and the computer can provide drill-oriented repetitive instruction which the teacher does not have time for on an individual basis. Packaged instructional series of all sorts, through which the student proceeds at his or her own pace, have the same function. Particular applications of these materials for students with special learning needs or learning disabilities could be developed.

Finally, innovative instructional methods may be developed through the use of this technology. Students can learn to use the technologies for self-expression. Student-developed as well as professionally-developed materials may be circulated among schools. Both students and teachers may view videotape recordings of classroom activities for feedback and self-evaluation.

4.2.3 Social Service Concepts

In the category of social services, the possible services may be classified in terms of services to be delivered to the community at large and services for special groups which have been identified: public assistance recipients, the elderly, the handicapped, youth, and minorities. These groups have been identified on the basis of their special needs and a past history of inadequate services to meet those needs.

For the community at large, the service which is most frequently singled out as being both valuable and particularly viable through telecommunications is that of dissemination of information and referrals services. Outreach into the community is a major concern of social service agencies; often services are available and are not utilized because of lack of knowledge on the part of the community members. In addition, even social workers have difficulty keeping up with information on all social service agencies; they, too, have a need for more efficient means of gaining social service information. Information management systems offer a possible solution to this problem.

Actual services rendered by social service agencies may incorporate telecommunications technology. Counseling and family planning activities are two possible services which need to be delivered more widely and comprehensively. The dissemination of pre-packaged material, along with creation of communications links between institutions, could further this goal.

Telecommunications technology may also offer a means of enhancing the democratic governmental process and promoting greater involvement of citizens in the government through the ability to create programs concerning local issues and candidates; and through the ability to allow individual citizens to create programs for the entire community ("Electronic Soapbox"). In this way, the individual has a greater opportunity to express opinions and to become more familiar with the governmental workings of the local area. The polling capability of interactive television systems suggests a possible means of gaining more feedback from citizens into the governmental process. Electronic "town meetings" have also been suggested as a means of informing citizens and involving them in the governmental process.

Another service for the community at large is the creation of video literacy workshops and community video centers. These centers provide community members with an opportunity for public access; community members can produce programs concerning activities and issues of interest to them and gain expertise with a new communications medium in the process. This service is discussed largely as a response to the fact that our communications media are controlled at present by several large companies, and the average citizen has little means of influencing or contributing to programming.

Public assistance recipients are a group to which a major allotment of government funds is made; however, it would appear that there is a wide dissatisfaction with the efficiency and equity of distribution of funds. Telecommunications technology, in conjunction with management information systems, making accurate and speedy eligibility determinations, keeping easily-accessible records, and making information widely available about who may qualify for public assistance services.

The elderly as a group suffer from severe isolation from the society, and this isolation affects their mental and physical health. Services needed by the elderly are "life enrichment" type services, which will bring them into closer contact with the community around them, as well as increased accessibility to medical services. Information on services available and instruction on coping with special aspects of modern life is needed. In addition, it has been suggested that the role of the elderly as "community historians" may be enhanced through the use of telecommunications. Videotapes and programs could be made in which the elderly share their knowledge of the past with the younger members of the community.

The handicapped are another group who suffer from social isolation, due to a lack of mobility and different needs. For the deaf, general programming using sign language and instruction in sign language and lip reading are possible services. Issues of interest to the deaf, self-help programming, and special cultural programming (Theatre for the Deaf) are other possible topics. Similar programming geared to the needs of the blind could be developed, including the service of talking books. Both the deaf and the blind could produce programming to explain about themselves as a group to the rest of the community.

The physically disabled could receive rehabilitative services similar to the above, as well as therapy using telecommunications technology. Therapeutic routines could be televised on real time or practiced at home through the use of a videotape. Information about facilities which are accessible to the handicapped could also be made available.

Youth development is another possible service to the community. In particular, programs aimed at delinquency prevention could be developed. Alternative educational patterns will be particularly useful for this group, which may be alienated from the conventional classroom. As one educator said when asked about the school dropout problem, "Set up the educational television in the pool halls--anywhere you can get the kids." In addition, counseling services could be made more readily available. Career education services also are needed by this group.

Minorities are another important group to be considered, for several reasons. First, in many cases, minority group members have special needs for social services because they are socially or economically disadvantaged. They need to be informed of their rights as minority group members and to be aware of recourse for discriminatory practices against them.

Second, minorities have always been under-represented in the mass media, and as a consequence, the minority cultures have not been understood or appreciated by other Americans. Cable television offers minority group members the opportunity for cultural access and cultural self-expression through public access programming.

4.3 Service Integration

4.3.1 Rationale

The underlying logic upon which integrated service delivery systems are based is that human beings are faced with a variety of problems, rather than "problem areas" which can be dealt with in isolation.[1] Therefore, a service delivery system which can solve client problems should be comprehensive, coordinated, and integrated. Particularly on a local level, multi-service programs have been found to be an effective method for meeting needs, because most human problems involve a complexity of factors rather than one categorical need. Integrated service delivery systems allow the service provider to respond to a problem on a number of different fronts. The objective of an integrated service delivery system is to offer, either directly or by referral, a range of services and activities to a given target population. Telecommunications-based service delivery systems may make a significant contribution to integrated service delivery because of their potential for extending communications between various agencies, institutions and personnel who may be geographically separated, thus allowing these agencies to work more profitably together.

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[1] Comprehensive Neighborhood Programs: A Guidance Manual, prepared by Abt Associates for the Office of Economic Opportunity, December, 1970, p. 8.

The main advantages of integrated service delivery systems are that they promote coordination of services, improve services delivered in quantity and diversity, help provide the right combination of services to meet multiple client needs, and improve the use of information to determine service program needs and priorities. Benefits in terms of efficiency of integrated service delivery over categorical service delivery may be described as an increase in the following factors:

- The number of units of services provided across agencies to all clients
- Client needs responded to
- Correspondence between needs presented and services provided
- The range of services provided
- The number of clients processed within a given time (e.g. six months) per worker or unit
- Planning, prioritizing, sequencing, and following up on client services
- Referrals among participating agencies
- Inter-services information sharing
- Shared problem solving among agencies regarding the service delivery process
- Cooperation among agencies' staff[1]

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[1] Anacostia Demonstration Project of Integrated Service Delivery, prepared by Abt Associates for DHEW, 1972)

Increased efficiency in service delivery enables service providers to reach a greater number of recipients and to deal more comprehensively with client service needs.

In addition, the interactive effects of various services provide benefits not associated with categorical service delivery. The reputation and visibility of the service delivery system is enhanced when in any one service area, a reputation is gained for producing good results. This reputation will contribute to full use of available services by the target population in question.

In the long range, innovations in service delivery will occur through the interaction of one service delivery mode with another, and innovations will also arise through new combinations of services. Better division of labor occurs, more comprehensive planning for service delivery becomes possible, and unnecessary duplications of services may be avoided.

For telecommunications-based service delivery projects, integrated service delivery has a number of special benefits. First, implementation of telecommunications systems usually involves large start-up costs in capital expenditure for the hardware. A system which is planned to meet several service needs will have a broader base for economic support as well as for other types of support. Second, the nature of telecommunications technology itself is to enhance interaction and to make communication more efficient. Linkages between institutions or individuals who have never before communicated become possible, and communications between institutions or individuals who already work together are facilitated. In this way, more resources are made available to the service recipients. For example, a child who comes to a neighborhood health clinic may be found to have a disease related to the social and economic circumstances of his or her home. A nurse or doctor could treat the physical symptoms and also be able to deal with the related other circumstances, through recourse to a referral system, or by putting the patient in contact with the other service provider directly through telecommunications.

Thus the model of neighborhood-based integrated service delivery systems is enhanced through the use of telecommunications. The neighborhood center is strengthened by the increase in availability of resources, and the major centralized service center is strengthened through the increased ability for management and storage of information and through the ability to receive as well as transmit information to the decentralized service delivery sites.

Increased linkages between centralized and decentralized service delivery sites promote comprehensive response to client needs because the ease of transference from one agency to another is increased. The advantage of these linkages is that the client can enter the system once and encounter services designed for a multiplicity of needs. If the client has to keep entering the service system at many different points, it is less likely that the service provider will have the opportunity to respond to multiple client needs. These multiple client needs may occur simultaneously or sequentially over time. In either case, higher-quality response to client needs will take place when the service system becomes more easily accessible to the client.

4.3.2 Criteria for Service Integration

The success of an integrated service delivery system will depend largely upon the care with which services are chosen for combination with one another. The two most general schemes for integration of services are integration based on client needs and integration based on system requirements. Planning of a client-oriented system involves identifying a suitable target population, listing all the possible needs of that group, and then designing a system responding to all these services needs. The potential problem of such a system is that services for one group become institutionalized, and duplicative service-systems develop. In planning a system-oriented service integration system, similar staff, space, and other support functions are matched to determine suitable services to integrate. Most viable service integration schemes will combine parts of both these orientations, achieving a balance between the two.

Four major criteria for service integration for telecommunications-based service delivery systems have been identified:

- Similar service users
- Corresponding program objectives
- Co-location of services
- Staff skills and function overlap

These criteria are sufficiently broad for general planning for service integration in the present study. In planning for a specific site, however, more detailed criteria must be developed to fit the particular mix of needs and systems in that location.

The purpose of identifying similar service users corresponds to the preceding discussion of client needs-oriented service integration. In site-specific planning, the suitability of certain integrated service systems for a particular site may be based upon demographic data and community needs assessment.

Corresponding program objectives serve as another criteria for integration of services. Services with common objectives will tend to produce results which are mutually reinforcing, thus achieving the aforementioned goal of enriching service delivery through results caused by the interaction of services. Achievement of certain service delivery goals will advance other goals. Programs may have corresponding objectives in that they aim to raise the standard of living of one particular client group, or in that they are aimed at solving a problem which crosscuts many groups.

Co-location of services is a systems-oriented approach to service integration. The classic example of integrated service delivery in the past has been the neighborhood-based service center.[1] The neighborhood service center is organized for maximum accessibility through close geographical location; the potential of telecommunications, however, alters the necessity of geographical proximity. Thus, the concepts underlying the neighborhod integrated service system may be transferred to a telecommunications-based system. The impact of telecommunications for these systems is not totally known at present. As mentioned previously, the advent of telecommunications technology may strengthen the neighborhood center by adding to its information resources and increasing the ease and speed with which information may be obtained. On the other hand, if telecommunications technology penetrated the community to the level of two-way interaction in the home, the value of the neighborhood service center may be minimized. Therefore, co-location of services is a dynamic criterion which will be viewed differently in telecommunications-based integrated service systems than in conventional service integration. In this analysis, co-location is interpreted to refer to presently centralized resource facilities, and to possible co-location of satellite centers to which these resources would be transmitted or transferred.

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[1] Comprehensive Neighborhood Programs: A Model with Three Applications, prepared by Abt Associates for the Office of Economic Opportunity, December 1970

Staff skills and function overlap is the fourth criterion for service integration. Staff capabilities are an operational consideration which, as in co-location of services, will be impacted by telecommunications links. For example, a neighborhood service center might determine services to be delivered on the basis of the multiple skills of a staff member. With telecommunications, however, on-site staff members may involve remote

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staff with a variety of additional skills in service delivery. Thus staff skill becomes much less of a limiting factor in the telecommunications system.

4.3.3 Application of Service Integration Criteria

The list of services in Section 4.2 has been classified in terms of these four criteria (see Figure 4.1). In general, concurrence on two or more of the criteria is deemed to be an adequate basis for including services in a particular cluster. In some cases, services with only one criterion in common are clustered because of the importance of that single link. While the distinction between health, education, and other social services is maintained, it should be remembered that the ultimate service packages suggested will cut across these service areas in several instances.

Figure 4.2 is a matrix of the health services/service integration criteria. Each cell entry indicates a fit between the specified health service and a service integration criterion (Note that the criteria have been broken up into sub-sets, thus allowing for multiple entries of a particular service for a given criteria). Figure 4.3 is a similar matrix for education while Figure 4.4 is the matrix for other social services. In examining the cell entries, it was possible to select clusters for each service area that fit similar criteria in similar ways. In some cases, a particular service correlated with more than one cluster (e.g. tutorial services), and in those cases the services were suggested as being appropriate for the other cluster(s) as well. As a result of this procedure, the initial

Figure 4.1 Service Integration Process

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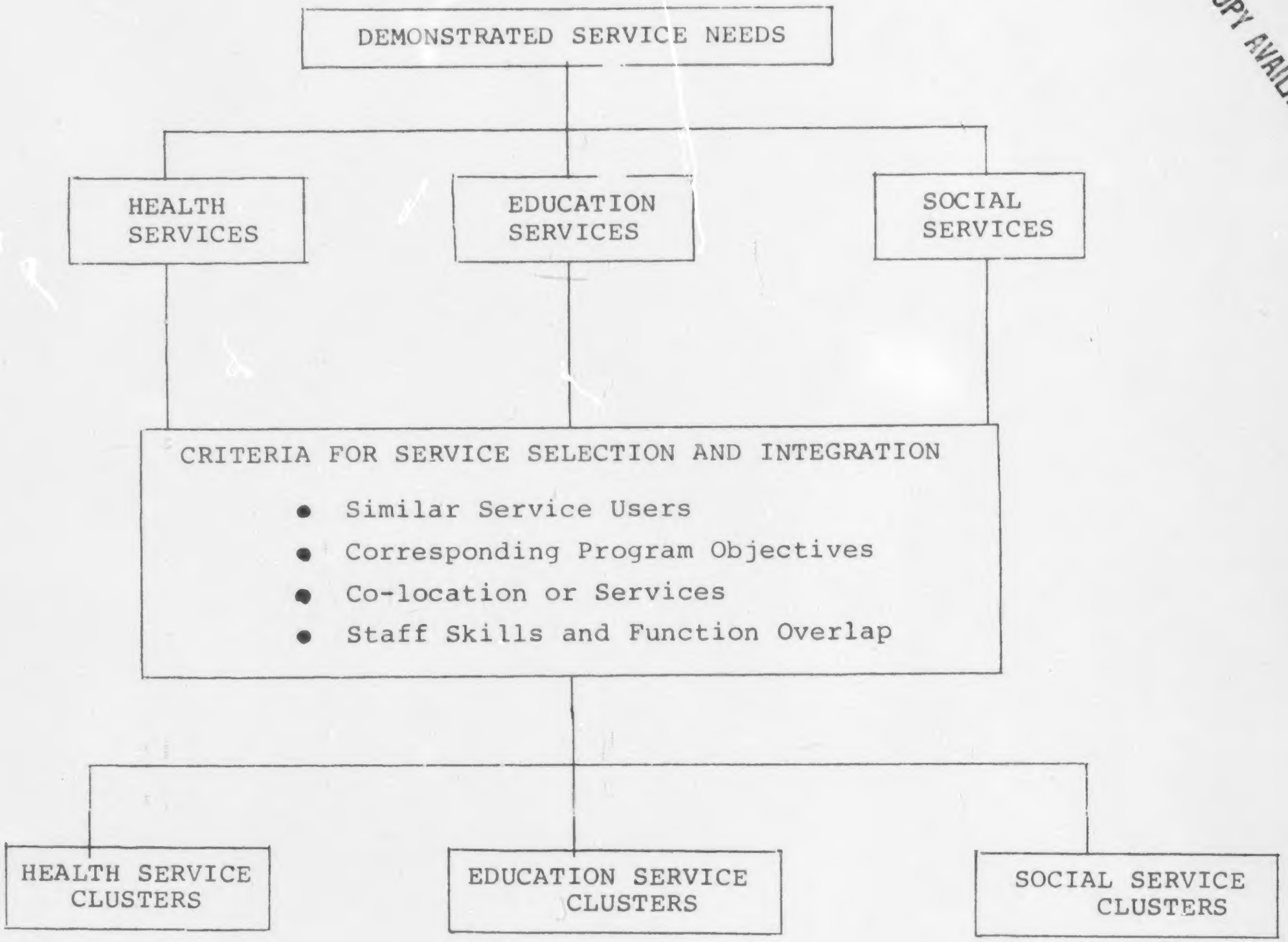
DEMONSTRATED SERVICE NEEDS
HEALTH SERVICES
EDUCATION SERVICES
SOCIAL SERVICES
CRITIERIA FOR SERVICE SELECTION AND INTEGRATION
• Similar Service Users
• Corresponding Program Objectives
• Co-location or Services
• Staff Skills and Function Overlap
HEALTH SERVICE CLUSTERS
EDUCATION SERVICE CLUSTERS
SOCIAL SERVICE CLUSTERS

list of services can be presented as 18 service clusters (7 health clusters, 5 education clusters, and 6 social service clusters). Figure 4.5 lists these clusters by service areas. These clusters of services which emerged from the process of identifying services with overlapping client users, objectives, locations, and staff skills will next be considered in terms of corresponding technologies, which will constitute a further criterion of service integration, particularly with respect to telecommunications, and in some cases will determine if specific services or service clusters are to be excluded or modified on technological grounds.

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Figure 4.2

Health Service Integration Matrix

	Similar Service Users											Corresponding Program Objectives								Co-location of Services						Staff Skills and Functions Overlap							
	Rural populations	General community	Youth	Elderly	Handicapped	Other socially isolated	Health professionals	Health administrators	Patients	Public assistance recipients	Minorities	Public access and local origination	Career Advancement	Increased Community involvement	Improved Education Level	Improved "Quality of life"	Increased Availability of Information	Reduced Social Isolation	Improved community health standard	Hospitals	Nursing homes	Schools	Neighborhood centers	Prisons	Homes	Communications Technology	Counseling and Psychiatric Social Work	Knowledge of service agencies & resources	Health Education	Career information	Curriculum development & instruction	Primary care delivery	Citizen involvement & community development
1. Public health information to the community		●								●	●								●	●		●	●		●				●				
2. Teleconsultation	●	●		●															●	●	●		●	●								●	
3. Nutrition information		●								●									●	●		●	●		●				●				
4. Prenatal and infant care		●								●	●								●	●			●									●	
5. Telemedicine applications using non-physicians	●	●		●															●	●	●		●	●								●	
6. Speech therapy via telecommunications	●				●															●		●	●									●	
7. Testing of sight and hearing		●																	●	●		●	●									●	
8. Videotape of rehabilitative process for treatment and records					●												●			●						●						●	
9. Patient monitoring							●													●												●	
10. Computerized patient history							●	●									●			●	●		●										
11. Computer data bank for medical information							●										●			●		●							●			●	
12. Video medical library							●										●			●		●							●			●	
13. Emergency medical network, involving fire, police, ambulances	●	●						●																									
14. Teleconsultation to prisons						●													●					●								●	
15. Patient visiting via telecommunications									●							●				●	●												
16. Administrative staff interaction								●									●			●	●		●	●									
17. Recording and transmitting of medical procedures for health students							●													●												●	
18. Patient entertainment via telecommunications									●							●				●	●												
19. Pharmacy services using telecommunications	●																		●	●			●									●	
20. Psychiatric remote diagnosis	●	●																	●	●			●				●					●	
21. Teletherapy for mental patients						●													●	●			●									●	
22. Computerized total hospital activities								●									●			●													
23. Video grand rounds							●													●												●	
24. Seminars via telecommunications							●										●			●		●	●									●	
25. Patient education									●						●			●											●				
26. Continuing education for medical professionals							●													●		●							●				
27. Drug education		●	●											●								●	●	●	●				●				
28. Videotapes for professional self-assessment							●													●						●			●			●	
29. Video display of minute surgical activities such as dental and opthalmic procedures							●													●						●			●				
30. Recording of psychiatric interviews for later group diagnosis							●													●			●			●	●					●	
31. CAI for medical education							●													●		●							●				

Figure 4.3

Education Service Integration Matrix

	Similar Service Users											Corresponding Program Objectives								Co-location of Services						Staff Skills and Functions Overlap							
	Rural populations	General community	Youth	Elderly	Handicapped	Other socially isolated	Health professionals	Health administrators	Patients	Public assistance recipients	Minorities	Public access and local origination	Career Advancement	Increased Community Involvement	Improved Education Level	Improved "Quality of life"	Increased Availability of Information	Reduced Social Isolation	Improved community health standard	Hospitals	Nursing homes	Schools	Neighborhood centers	Prisons	Homes	Communications Technology	Counseling and Psychiatric Social Work	Knowledge of service agencies & resources	Health Education	Career information	Curriculum development & instruction	Primary care delivery	Citizen involvement & community development
1. Adult education	●	●								●	●				●	●						●	●	●	●						●		
2. High school equivalency courses		●	●			●				●	●		●		●								●	●	●						●		
3. College course work offered in conjunction with particular universities	●	●				●																											
4. Career education			●							●			●									●			●					●			
5. Early childhood development			●												●								●		●						●		
6. Resource-sharing among schools															●							●											
7. Tutorial services			●												●							●	●	●	●						●		
8. Open University				●	●	●							●		●								●		●								
9. CAI for individualized instruction			●												●		●					●				●							
10. Videotaping of children in educational setting for later viewing by parent and teacher															●							●				●							
11. Education programs for drop-outs in community centers			●												●								●								●		
12. Courses for those confined to the home: housewives, handicapped, elderly				●	●	●									●	●									●						●		
13. Programs for the non-English speaking											●		●		●							●	●		●						●		
14. Student produced programs			●									●			●							●	●			●							
15. Classroom self-paced learning			●												●							●									●		
16. Library Resource Sharing	●	●															●																

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Figure 4.4

Social Service Integration Matrix

	Similar Service Users											Corresponding Program Objectives								Co-location of Services						Staff Skills and Functions Overlap							
	Rural populations	General community	Youth	Elderly	Handicapped	Other socially isolated	Health professionals	Health administrators	Patients	Public assistance recipients	Minorities	Public access and local origination	Career Advancement	Increased Community Involvement	Improved Education Level	Improved "Quality of life"	Increased Availability of Information	Reduced Social Isolation	Improved community health standard	Hospitals	Nursing homes	Schools	Neighborhood centers	Prisons	Homes	Communications Technology	Counseling and Psychiatric Social Work	Knowledge of service agencies & resources	Health Education	Career information	Curriculum development & instruction	Primary care delivery	Citizen involvement & community development
1. Determination of eligibility		●								●																		●					
2. Repetitive learning for handicapped or retarded															●																●		
3. Maintaining and updating records	●	●							●	●							●																
4. Administrative coordination using telecommunications group conferencing																	●											●					
5. Decentralized social service centers	●	●																					●					●					
6. Hotlines for referral and counseling		●	●	●		●											●						●		●		●	●					
7. Twenty four hour service centers		●	●	●		●											●						●		●		●	●					
8. Crisis intervention			●	●	●																												
9. Client involvement in social service decision making		●							●	●				●																			●
10. Coordination of localities, states and regions for planning																	●											●					
11. Social service information to general public		●															●								●			●					
12. Reduced social isolation of the elderly				●												●		●			●		●		●								●
13. Social service information for the elderly				●													●	●			●		●		●			●					
14. Rehabilitative services for the handicapped					●								●												●		●	●					
15. Employment referrals and information			●		●					●	●		●				●											●		●			
16. Counseling services		●																									●	●					
17. Family planning		●															●																
18. Youth development and delinquency prevention			●																								●						
19. Specific service referral from neighborhood centers		●															●						●					●					
20. Neighborhood information		●												●			●						●					●					●
21. Centralized referral from home inquiry		●															●								●			●					
22. Cultural access and expression				●		●					●	●		●		●		●															
23. Public affairs information		●										●		●			●																●
24. Electronic town hall		●										●		●			●						●		●								●
25. Electronic Soapbox		●		●						●	●	●		●			●						●		●								●
26. Citizen referenda		●												●											●								●
27. Video literacy workshops		●										●		●									●	●		●							
28. Community video center		●										●		●			●							●		●							
29. Community outreach	●	●	●	●	●	●					●			●										●									●
30. Information on rights and anti-discrimination procedures	●									●	●																	●					
31. Information dissemination to welfare recipients										●							●											●					
32. Cultural programming for the handicapped					●											●		●															
33. "Life Coping" skills				●	●	●										●		●							●								
34. Vocation training		●	●		●	●				●	●		●									●	●	●	●					●	●		

Figure 4.5

Health Service Clusters

Cluster A	Cluster B	Cluster C	Cluster D	Cluster E	Cluster F	Cluster G
Public Health Information to the Community Nutrition Information Pharmacy Services Drug Education	Teleconsultation and Diagnosis Telemedicine Applications Using Non-Physicians Teleconsultation to Prisons Administration Staff Interaction Psychiatric Remote Diagnosis Teletherapy for Mental Patients Recording of Psychiatric Interviews for Later Group Diagnosis	Prenatal and Infant Care Speech Therapy Testing of Sight and Hearing Telemedicine Using Non-Physicians	Videotape of Rehabilitative Process for Treatment and Records Recording and Transmitting of Medical Procedures for Health Students Video Grand Rounds Seminars Continuing Education for Medical Professionals Videotapes for Professional Self-Assessment Videotape Display of Minute Surgical Activities such as Dental and Opthalmic Procedures CAI for Medical Education	Patient Monitoring Patient Visiting Patient Entertainment Patient Education	Computerized Patient History Computerized Data Bank for Medical Information Video Medical Library Computerized Hospital Activities CAI for Medical Education	Emergency Medical Network

Education Service Clusters

Cluster A	Cluster B	Cluster C	Cluster D	Cluster E		
Adult Education Career Education Courses for Those Confined to the home	High School Equivalency Courses Career Education Tutorial Services Education Programs for Drop Outs in Community Centers Education Programs for the Non-English Speaking	College Course Work Offered in Conjunction with Universities Tutorial Services Open University CAI for Individualized Instructions Classroom Self Paced Learning Student Produced Programming	Early Childhood Development Videotape of Children in Education Setting for Later Viewing by Parent and Teacher Student Produced Programming	Resource-Sharing Among Schools Resource-Sharing Among Libraries		

Social Service Clusters

Cluster A	Cluster B	Cluster C	Cluster D	Cluster E	Cluster F	
Determination of Service Eligibility Maintaining and Updating Records Decentralized Social Service Centers Regional Coordination of Social Service Agencies Administrative Coordination Using Telecommunication Group Conferencing Client Involvement in Social Service Decision Making	Repetitive Learning for Handicapped or Retarded Reduced Social Isolation of the Elderly Rehabilitative Services for the Handicapped Family Planning Cultural Programming for the Handicapped "Life-Coping" Skills	Social Service Information to General Public Social Service Information for the Elderly Employment Referrals and Information Neighborhood Information Public Affairs Information Information on Rights and Anti-discrimination procedures Information Dissemination to Welfare Recipients	Youth Development and Delinquency Prevention Family Planning Counseling Services Community Outreach Vocational Training "Life-Coping" Skills	Specific Service Referral from Neighborhood Centers Hot Lines for Referrals and Counseling Twenty-Four Hour Service Centers Crisis Intervention Employment Referrals and Information Centralized Referral from Home Inquiry Community Outreach	Cultural Access and Expression Public Affairs Information Electronic Town Hall Electronic Soapbox Citizen Referenda Video Literacy Workshop Community Video Center Client Involvement in Social Service Decision Making	

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5.0 SERVICES/TELECOMMUNICATIONS TECHNOLOGY OPTIONS

5.1 Overview

In the previous section, the range of services suggested for the various service packages were clustered in terms of their potential for service integration. This section discusses the range and the limitations of the various telecommunications technologies that can potentially provide these services. There are several alternative transmission systems available and we have chosen to discuss the technologies in terms of cable and non-cable. While this is a gross oversimplification, we have discovered, in examining the means of delivering the services, that for health, education and other social services, the presence of a cable system (one-way or two-way) greatly enhances the delivery capability.

While non-cable system technology can be highly sophisticated (e.g., computers, CCTV, microwave and MDS , and ITFS), from a practical standpoint of establishing a demonstration project in the immediate future, we must rely on already available telecommunications systems, or at the least. systems that are anticipated to be operable within the next 18 months. Exceptions to this assumption might lie in specific institutional linkages in which federal funds may be made available for either cable or microwave hookups.

The non-cable technologies on which we have concentrated our effort have been primarily CCTV, computer, telephone, and videotape.

There are instances in which the substitutability of microwave for cable linkage is appropriate, but such a determination would have to await more specific site selection criteria. We have examined a broad range of computer applications ranging from data storage to hard copy transmission from institution to institution using telephone lines. Videotape is also being presented as a technological option because for those areas without cable, extensive use of videotape (both packaged and locally originated) were found to have a great many applications.

For cable systems, the most wide-spread technology is one-way coaxial cable, non-addressable (e.g., any individual on the cable hookup can tune in to the channels), usually with 10 channels or less, and containing no response (or upstream capability). Applications of this system for service delivery are relatively limited; however, one can provide extensive general information, and some video education where immediate feedback is not required. The important aspect of this system is that it is highly software/programming intensive (whether videotape or live), since no form of interaction occurs.

It is the tacit assumption in this discussion that television in the U.S. is virtually omnipresent. This is supported by the fact that TV penetration is approaching 100%, with almost 60% of this penetration being color receivers. An almost equally available communications mode is the telephone. Thus, when the one-way cable system is combined with the telephone, one is provided with a relatively immediate audio response mechanisms. (The limitation of this immediacy is the possible delays caused by backlogs due to simultaneous usage of the telephone lines.) Once the telephone becomes available, in conjunction with the cable system, the level of services that can be provided is correspondingly upgraded. Furthermore, the technologies of dial-access, framegrabbing, scrambling devices, and one-way facsimile transmission allow for even greater applications, particularly for specialized audiences.

Two-way cable technology suggests both a wealth of new service delivery opportunities or a Pandora's box, depending upon which constituency one is talking to. Experimentation in two-way cable applications has been elaborate, if not extensive. From the perspective of social service delivery, it is our belief that, with the exception of certain institutional linkages, interactive service delivery capabilities to the home on a wide-scale basis will not fall within the time-frame of this proposed demonstration. As previously mentioned, the National Science Foundation has recently funded several two-way operations to determine the feasibility of two-way (interactive) service delivery, and it will be of extreme importance for future demonstration planners to observe the progress made in these efforts. This does not preclude two-way from the array of service packages presented in this report, but is merely a word of caution as to time-frame and costs.

5.2 Technology Options for Health Services

From our examination of the telecommunications technology related to health services, there has been a technical diversity of techniques and uses. Most striking has been the great proliferation of videotape recording and playback equipment in the various experiments. However, usage of closed circuit television, cable television (one-way and two-way), microwave, telephone (audio and digital), and computers are also quite common. Less frequently used has been broadcast radio and television.

Tape systems have the inherent advantage of being used for both recording and playback. Health and medical services represent just one area in which one typically finds VTR users. Other institutional users include business, education, industry, and government. Since the introduction of reel to reel VTR's to this market in about 1967, the accumulated units in service have reached a level of 125,000 to 150,000.

To the extent that the computer has an economical and operationally useful role in solving health care problems, it has been employed. For example, the computer has been invaluable to taking protocols in the following ways.

- The computer offered a reliable way of insuring that the complexity of the protocol logic was followed accurately at every interview.
- Computer software allowed changes in the medical content of protocols to be made easily during development and then permitted administering a uniform protocol at many operating sites with minimal time lag.
- The printout of the encounter by the computer could be styled for the physician in English text and in medical terms.
- A record could be retained in machine readable form of that portion of the medical record that would be required for asking the questions to be posed at the next encounter with the paramedic and the computer.

- Since the responses were available to the computer, it made possible the statistical manipulation of data accumulated over a number of encounters.

In general, any lack of telecommunications application to health care education has been less due to "careless diffusion and deployment" than to costly technology and/or ignorance of the technology's existence. Telemedicine schemes will eventually make full use of all current forms of telecommunications. Patient medical data, such as LKG, EEG, etc., can be effectively transmitted over voice grade telephone lines in an IRIG narrow band FM multiple format. They can be demodulated in real time and subjected to further computer analysis and pattern-recognition techniques. Already, feasibility has been established for such transmissions on a routine basis over international voice-grade telephone circuits.

Video information further enhances quality and quantity of medical information transfer. Where channels are restricted to voice bandwidths, slow-scan techniques are thoroughly feasible, and sequential optical filtering with color photography now allows transmissions of color images.

Radio transmissions in High Frequency portions of the spectrum are already suited to these narrow band requirements for distance beyond VHF and UHF coverage. The latter, however, will be increasingly used both for direct communications between outlying fixed or mobile clinic and regional medical centers and also in providing links to satellites. At UHF frequencies, high resolution two-way TV coverage can be planned.

With increasing use of CATV systems, it becomes possible for transmission of medical data from the home to the doctor or hospital. Although there appear to be no insuperable technical obstacles, there may well be certain problems of privacy of information in such implementation, but this can possibly be alleviated by scrambling devices.

5.3 Technology Options for Education Services

In searching for new approaches to the provision of educational services, the primary goal is to increase the quality and availability of education for all who desire it. There are new potentials for improving the educational processes both in our cities, on our campuses, and in remote rural areas. These are closely linked with the advancing technology of broadband communications and the use of the video tape recorder and the computer as cost effective educational tools. Of particular importance to education of the future is the capability of this technology to provide services to large numbers of geographically dispersed people on an individualized basis. The availability of low-cost CATV channels and provisions for student interaction with educational materials promises to add a new dimension to education.

Computer-assisted instruction (CAI) is basically a dialogue between a student and a computer, with the computer side of the dialogue having been programmed by a teacher. Since the computer responses have been created by the teacher, the quality of the dialogue depends upon the teacher's ability to anticipate the student's actions and program responses appropriate to them.

CAI promises to be of great value as a way of individualizing instruction without the need for human instructors.

It is reasonable to expect that in time cablevision channels committed to education will provide a rich fare of films, tapes and lectures which the student can view in his home. Videotape is becoming more reliable and less costly to use and thus should be recognized as an important new medium of expression for students as well as faculty. It is reasonable to expect that students will use videotape as a medium for presentation of thesis materials.

It may be possible for a student to interrogate a library catalog from a computer terminal in his home. A single combined catalog for a community could indicate whether the document is in the stacks or on loan. It may also be possible for a student to reserve documents and to have them delivered to a place from which he can conveniently pick them up.

Furthermore, it may be possible for an instructor to arrange to have selected documents made available by videophone, by display, or printing computer terminal for use by students. In this way, a single copy of a document might serve many students without the need for them to visit a library for the purpose.

The computer terminal is ideal for computation and data processing. Using a high-level language such as APL, students from possibly the fifth grade up will have full access to the computer for computation and data processing studies. Data banks will be available for student use. These might, for example, contain census data which the student could use for independent data processing studies.

As new media for teaching become available, a typical course may employ several media appropriate to its goal. In addition to lectures and books, on which many courses place exclusive reliance today, a course may employ videophone classes, films, videotapes or lectures on cable vision, computer-assisted instruction, video reference to information in the library, and use of computer terminal for computation, data retrieval and document preparation.

In the future, we hope to see more experimentation and applications of two-way educational delivery systems, interactive community information retrieval systems, and computer-assisted instruction.

5.4 Technology Options for Other Social Services

The outreach function of social services have traditionally used such telecommunications technology as the telephone (audio), broadcast radio and television, and one-way cable. In the future, however, functions such as counseling and client training will make an ever increasing use of two-way cable and computers, in addition to the above mentioned technology.

Information and referral as well as intake can be expected to continue to use audio and digital telephone, and one-way and two-way cable and computers. In addition to the conventional broadcasting and one-way CATV/computer systems, telecommunications systems that might be used in different ways to improve the administration and delivery of various types of social services are two-way CATV systems and two-way CATV/computer systems.

Two-way CATV systems are those types that provide point-to-point signal transmission between two or more specific terminals in the system through the use of switches and time-shared or frequency-divided channels. Other two-way communications systems include: fixed radio communication systems, mobile radio communication systems, and satellite communication systems.

Two-way CATV/computer systems are generally similar to two-way CATV, except that computers are used either as system functions, other than circuit switching, or message store-and forward operations. In some cases, the communications set is used in these systems primarily to transfer data and programming material between computers located at terminal points. In other cases, the computers are used to perform various integral functions of the system, such as the filing and storage, at modal points, of information that is sent from terminals and later retrieved at these same terminals. In addition to two-way CATV, other potential two-way computer/communication systems to community services usage include: mobile radio computer/communication systems, landline computer/communication systems, and satellite computer/communication systems.

5.5 Telecommunications Technology and Service Cluster Linkages

A key step in the development of service packages is the linking of the service clusters developed in Chapter 4.0 with the technological options available. Figures 5.1, 5.2, and 5.3 present technology matrices for the areas of health, education, and other social services respectively. A cell entry indicates that the service in question can be delivered by the corresponding technology. At this point, however, no comparative analysis of which option is most appropriate has been made, for the criterion is not technological efficiency but technological feasibility. Thus, for example many of the services involving transmitting specific information to specific populations are probably most effectively (and cheaply) done by one-way cable, a cell entry is also made for VHF and UHF television broadcast because the information can be transmitted through this medium as well. The costs, in most instances, for widespread use of over-the-air broadcast for specific information dissemination would be prohibitive, but in some instances there may be a service provider who is willing to pay the price to reach an audience.

A closer look at the cell entries in the above figures gives some idea of the potential for each of the technologies to provide the services in the given clusters. It is readily apparent that videotape is an appropriate technology for one-way dissemination of general information that can be used over and over again. This is true for hospitals, schools, and neighborhood centers. Another technology that has an application across service areas is the telephone, either in conjunction with a computerized

Figure 5.1

Telecommunications Technology/ Health Clusters

	Videotape	Telephone	Radio Broadcast	Television Broadcast	Closed Circuit TV	One-Way CATV	One-Way CATV with Telephone	Two-Way CATV with Digital Response	Two-Way CATV with Audio Response	Two Way CATV with Full Video	Computers	Facsimile Transmission
A. ● Puolic Health Information	●	●	●	●		●						
● Nutrition Information	●	●	●	●		●						
● Pharmacy Services		●			●		●		●	●		
● Drug Education	●	●	●	●		●						
B. ● Teleconsultation and Diagnosis					●		●		●	●		
● Telemedicine Applications Using Non-Physicians		●					●		●	●		
● Teleconsultation to Prisons					●		●		●	●		
● Administrative Staff Interaction		●			●		●	●	●	●		●
● Psychiatric Remote Diagnosis		●			●							
● Teletherapy for Mental Patients		●			●							
● Recording of Psychiatric Interviews for Later Group Diagnosis	●											
C. ● Prenatal and Infant Care		●			●		●		●	●		
● Speech Therapy					●				●	●		
● Testing of Sight and Hearing					●	●	●		●	●		
● Telemedicine Using Non-Physicians		●					●		●	●		
D. ● Videotape of Rehabilitation Process for Treatment and Records	●											
● Recording of Medical Procedures for Health Students	●										●	
● Video Grand Rounds						●	●		●	●		
● Seminars				●	●	●			●			
● Continuing Education for Medical Professionals							●					
● Videotapes for Professional Self-Assessment												
● Video Displays of Minute Surgical Activities such as Dental and Opthalmic Procedures					●	●			●	●		
● CAI for Medical Education											●	
E. ● Patient Monitoring					●	●						
● Patient Visiting		●			●		●		●	●		
● Patient Entertainment	●		●	●	●	●						
● Patient Education	●		●	●	●	●						
F. ● Computerized Patient History											●	
● Computerized Data Bank for Medical Information											●	
● Video Medical Library	●										●	
● Computerized Hospital Activities											●	
● CAI for Medical Education											●	
G. ● Emergency Medical Network		●					●		●	●		

Figure 5.2

Telecommunications Technology/ Education Clusters

	Videotape	Telephone	Radio Broadcast	TV Broadcast	Closed Circuit TV	One-Way CATV	One-Way CATV with Telephone	Two-Way CATV with Digital Response	Two-Way CATV with Audio Response	Two-Way CATV with Full Video	Computers	Facsimile Transmission
A. ● Adult Education	●		●	●	●	●	●	●				
● Career Education	●		●	●	●	●						
● Courses for Those Confined to the Home				●		●	●	●	●			
B. ● High School Equivalency Courses				●	●	●						
● Career Education	●		●	●	●	●	●					
● Tutorial Services	●	●					●	●	●		●	
● Educational Programs for Drop Outs in Community Centers	●				●	●			●	●		
● Educational Programs for the Non-English Speaking				●	●	●			●	●		
C. ● College Course Work with Linkage of Universities				●		●				●		
● Tutorial Services	●	●					●	●	●		●	
● Open University	●					●	●	●	●	●	●	●
● CAI for Individual Instruction								●			●	
● Classroom Self-Paced Learning	●				●						●	
● Student Produced Programs	●				●	●						
B. ● Early Childhood Development	●				●					●		
● Videotape of Children in Educational Setting for Later Viewing by Parent and Teacher												
● Student Produced Programming					●	●						
E. ● Resource-Sharing Among Schools	●	●								●	●	●
● Resource-Sharing Among Libraries	●	●								●	●	●

Figure 5.3

Telecommunications Technology / Social Service Clusters

		Videotape	Telephone	Radio Broadcast	Television Broadcast	Close Circuit TV	One-Way CATV	One-Way CATV with Telephone	Two-Way CATV with Digital Response	Two-Way CATV with Audio Response	Two-Way CATV with Full Video	Computer	Facsimile Transmission
A.	● Determination of Service Availability		●									●	
	● Maintaining and Updating Records											●	
	● Coordination of Social Service Agencies		●									●	
	● Administrative Coordination Using Telecommunications for Group Conferencing		●					●		●	●	●	●
	● Client Involvement in Social Service Decision-Making							●	●	●	●		
B.	● Repetitive Learning for Handicapped or Retarded	●					●		●	●	●		
	● Reduced Social Isolation of the Elderly	●	●	●	●		●				●		
	● Rehabilitative Services for the Handicapped	●				●			●		●		
	● Family Planning	●			●	●	●						
	● Cultural Access and Expression	●		●	●		●	●					
	● Cultural Programming for the Handicapped	●			●		●	●					
	● "Life-Coping" Skills	●			●		●	●		●			
C.	● Social Service Information to General Public	●	●	●	●		●	●					
	● Social Service Information for the Elderly	●	●	●	●		●	●					
	● Employment Referrals and Information		●		●		●	●					
	● Neighborhood Information	●	●	●	●		●	●					
	● Public Affairs Information		●	●	●		●	●					
	● Information on Rights and Anti-Discrimination Procedures		●	●	●		●	●					
	● Information Dissemination to Welfare Recipients		●	●	●		●	●					
D.	● Youth Development and Delinquency Prevention							●		●	●		
	● Family Planning	●			●	●	●						
	● Counseling Services		●							●	●		
	● Community Outreach			●	●		●						
	● Vocational Training	●			●		●				●		
	● "Life-Coping" Skills	●			●		●	●		●			
E.	● Specific Service Referrals from Neighborhood Centers		●					●		●	●		
	● Hotlines for Referrals and Counseling		●							●	●		
	● 24 Hour Service Center		●					●		●	●		
	● Crisis Intervention		●					●		●	●		
	● Centralized Referral from Home Inquiry		●										
	● Community Outreach			●	●		●						
F.	● Cultural Access and Expression	●		●	●		●	●					
	● Public Affairs Information		●	●	●		●	●					
	● Electronic Town Hall							●		●	●		
	● Electronic Soapbox						●			●	●		
	● Citizen Referenda							●	●	●	●		
	● Video Literacy Workshops	●					●						
	● Community Video Center	●					●						
	● Client Involvement in Social Service Decision-Making							●	●	●	●		

referral network, or for providing audio or digital upstream information in a one-way CATV system.

The next step in the development of the "packages" is to eliminate those service/technology combinations that are least suited for the delivery of the service and to combine those combinations that are both highly suited to delivery and allow optimal flexibility in delivering other clusters of services, through adaption of other telecommunications hardware.

5.6 Proposed Service/Technology Packages

The service/technology packages presented on the following pages have been developed in accordance with the criteria for service integration discussed in Section 4.3.2 and the criteria for matching technologies to service clusters discussed in this chapter. The seven packages are also all responsive to the following three considerations:

- The need for demonstration of the service/technology mix
- The ability of the package to provide a variety of services using one or two compatible technologies
- The extent to which the service packages are flexible and may be expanded in a modular fashion

The first item is important because the main purpose of this study is to determine in what ways and in what areas telecommunications may be incorporated into the fabric of service delivery. Certain telecommunications uses have already been adequately demonstrated, and there is no need to further demonstrate their applicability in this situation. On the other hand, no totally novel applications have been developed for this study, because research into the field has shown that examination of some of the half-performed or incompletely-demonstrated applications has higher priority than any attempts to generate new ideas purely for the sake of novelty. The most innovative aspect of the current work is the suggested integration of services, along with the combinations of technologies. This ability to deliver a range of related services on the basis of one or two compatible technologies has been the aim in designing the service/technology packages.

The final consideration is one concerned with planning implications for the future. Flexibility is important in the service delivery mechanism, as has been discussed fully throughout this report, and in addition, hardware should have the ability for easy expansion, with minimum impact on existing hardware configurations.

The service packages should provide the planner with a basic framework which may then be applied and adapted in a community, after analysis of target population needs and local institutional constraints. The services are listed in the fullest reasonable groupings. In a specific application, certain services would be eliminated from each package, and services might be added in response to the needs of the community.

5.6.1 Service Package A: Hospital Services Using Videotape and Computers

This service package may be instituted within a single hospital or medical center, although the computer data might be transferred to another outlying health facility. The services to be delivered basically involve recording and organizing of medical data through the use of videotape and computers. The following services, which include portions of various health and social service clusters, may be delivered through such a system.

- Recording of psychiatric interviews for later group diagnosis
- Videotape of rehabilitative process for treatment and records
- Recording of medical procedures for health students
- CAI in medical education
- Computerized patient history
- Computerized data bank for medical information
- Video medical library
- Computerized hospital activities
- Public health information
- Nutrition information
- Drug education
- Rehabilitative services for the handicapped
- Family planning
- Determination of (health) service availability
- Coordination of (health) agencies

Future expansion of such a system could involve videotape sharing between hospitals and other health institutions, possibly instituting cable linkages. Computer data similarly may be transmitted between institutions.

5.6.2 Service Package B: Service Referral Computer Data Bank with Telephone Access

A centralized source of referrals to services may be demonstrated as a service/technology package in itself or as a component of other service networks. These services could be delivered through a data bank accessed by community members via telephone:

- Determination of service availability
- Maintaining and updating records
- Coordination of social service agencies
- Social service information to the general public
- Employment referrals and information
- Neighborhood information
- Public affairs information
- Information on rights and anti-discrimination procedures
- Information to welfare recipients
- Hotlines for referral and counseling
- 24-hour service centers
- Crisis intervention
- Centralized referral from home inquiry
- Public health information
- Nutrition information

- Pharmacy services
- Drug education

Information on the above-mentioned topics would be collected from all the related agencies in a given community and the information would be programmed so that the person accessing the computer would obtain relevant data on the problem to be solved, and the computer would list agencies which will meet the need. The computer capability makes continual updating of the information an easy task. The computer which serves as a basis for this referral system could be owned by the city for municipal uses and leased to participating agencies. A number of cities already have time-sharing capabilities, so that the referral service package may be relatively inexpensive and easily adapted to current facilities.

The greatest costs would be in the start-up, as information is gathered from all the social service agencies. In the case of large urban centers, this data collection may be a complex task. From an overall prospective, however, savings should result from the lack of duplication of effort associated with centralization of resource information which will more than compensate for the expense related to such centralization. Benefits may also be calculated on the basis of increased accessibility of services to community members.

A future expansion of this system would include linking the data bank to various service institutions, so that service providers there may access the information.

5.6.3 Service Package C: Community Involvement Project using One-Way Cable Television

In this service/technology package, the concept of the community video center is expanded to include greater dissemination of programming through a community cable television center. The community cable television project is based upon the idea that television may be used as a medium for community members to express and exchange ideas. A community center with equipment and technical assistance available to community members to produce their own programming and a channel or channels reserved for this public access programming are the necessary components of this community involvement service/technology package. The following services may be delivered:

- Cultural access and expression
- Public affairs information
- Electronic soap box
- Video literacy workshops
- Community video center
- Community outreach
- "Life-coping" skills
- Neighborhood information
- Reduce the social isolation of the elderly
- Cultural programming for and by the handicapped
- Student-produced programming

Programming may be produced by and for community members, particularly those with special needs and interests.

This service/technology package can be inexpensive and relatively easy to implement. In a non-cable community, the community video center concept could also be useful, however, the impact would be much more limited than in a community where the community-produced programming could be transmitted directly into the homes.

5.6.4 Service Package D: Educational Services Delivered Through One-Way Cable Television with Call-Back Capacity

Cable links to institutions such as industrial sites, nursing homes, prisons, hospitals, neighborhood centers, and homes enable individuals to receive instruction without having to travel to a centralized educational facility. Telephones may be used to provide a student capability for upstream audio access. The chief advantage of this service/technology package is that it increases the accessibility of education, thus allowing adults and non-traditional students to receive instruction. The following services are possible in this service/technology package:

- Adult education
- Courses for those confined to the home
- Open University
- Continuing medical education
- Career education

Although the list of services is short, each service listed here addresses a range of possible subject matter and a number of target populations. Therefore, these services have been considered adequate in themselves to constitute a service package.

The logical technological extension of this service/technology package is full two-way video transmission between institutions previously linked with one-way cable and telephone callback.

5.6.5 Service Technology Package E: Innovative Classroom Education with Computer and Closed-Circuit Television

Increased awareness of the special needs of each student in a traditional classroom setting makes a service/technology package such as this one valuable to educators. Computers may be used to free the teacher from routinized tasks and to provide individually-paced learning for each student. Closed-circuit television is used to increase the resources available to the classroom teacher. The following services may be delivered in the classroom using these technologies:

- Classroom self-paced learning
- Computer-assisted instruction
- Student-produced programs
- Resource-sharing among schools
- Resource-sharing among libraries
- Career education
- Educational programs for the non-English speaking

Once programming is developed to deliver these services, it may be widely employed by many schools. Programs may be distributed by mail to a number of schools, or, if the schools are linked through telecommunications at a later date, may be transmitted by cable. Libraries may also develop programming to be shown within schools. High quality software forms the basis for success of this service/technology package.

5.6.6 Service Package F: Interactive Television for Education and Social Service Delivery in the Home

Interactive television refers here to a system in which the viewer receives full video programming, or programming using a frame-grabber and has a digital response capability. This technological system constitutes the most sophisticated television system which may now be implemented in the home, due to bandwidth constraints. If a home viewer has full two-way video capability, one channel of spectrum space is required. Even in a system with 25 to 40 channels, the bandwidth is inadequate to support this two-way video service to an entire community. Frame-grabbing is a method whereby many viewers may share one channel, and hence it is most appropriate for home use.

The interactive capability basically gives the viewer the opportunity to make requests and to control particular aspects of the program through his or her responses. The viewer also has the opportunity to express opinions through the electronic polling capability. The following services are suitable for delivery by this mode.

- Adult education
- Courses for those confined to the home
- Tutorial services
- CAI for individual instruction

- Open University
- Client involvement in social service decision-making
- Repetitive learning for the handicapped or retarded
- Rehabilitative services for the handicapped
- Citizen referenda

As in service/technology Package E, development of high-quality software is crucial to the success of such services. Collaboration between curriculum developers, television programmers, and computer programmers is necessary to insure that balanced, useful programs are developed. This service/technology package will be particularly valuable to home-confined groups such as housewives, the elderly, and the handicapped.

5.6.7 Service Package G: Two-Way Institutional Network for Communication and Resource-Sharing

A point-to-point network connecting major service delivery institutions is the most suitable application for two-way video transmission. A number of previous experiments have connected pairs of institutions in this way, and the more the network is expanded to include different types of service institutions, the more possibilities for integrated service delivery systems will arise. The following services can be delivered over such a system:

- Telemedicine applications using non-physicians
- Teleconsultation and telediagnosis
- Teleconsultation to prisons
- Administrative staff interaction

- Pharmacy services
- Prenatal and infant care
- Speech therapy
- Testing of sight and hearing
- Video grand rounds
- Video displays of minute surgical procedures such as dental and opthalmic procedures
- Patient visiting
- Emergency medical network
- College course work with linkage of universities
- Resource-sharing between schools
- Resource-sharing between libraries
- Reduce social isolation of the elderly
- Rehabilitative services for the handicapped
- Counseling
- Vocational training
- Specific service referrals from neighborhood centers
- 24-hour service center
- Crisis intervention
- Electronic town hall
- Electronic soap box

Inclusions of various types of service institutions will suggest services beyond this list as well. This service/technology package is extremely comprehensive, and previously-suggested service/technology packages could function as one component of this city-wide or regional network of service institutions. The possible institutions in such a network include major medical centers, neighborhood health clinics, nursing homes, health professions schools, universities, prisons, libraries, social service agencies, and others to be determined on the basis of specific sites.

6.0 COST AND HARDWARE SYSTEMS ANALYSIS

The service packages just described suggest a broad array of potential service applications. Demonstrations of the package should in the aggregate show clearly the potential for telecommunciations in generating new services and in reducing the cost of more traditional ones. The present chapter examines the hardware and associated costs of the systems that are the technological backbone of the packages. The approach taken here is to postulate a number of alternative comprehensive "systems" based upon either existing demonstration hardware or off-the-shelf components; to calculate the expected cost of each of these systems and to suggest some possible existing experiments which could be implemented (perhaps in different ways) as part of one or more of the suggested demonstration packages.

The packages of services cited in Chapter 5.0 obviously do not correspond directly with the technology systems we are about to analyze. However, these packages do utilize these systems, either singularly or in tandem, and therefore a cost analysis of the packages would be a cost analysis of the various aspects of the system needed to deliver the level of services required.

The further step, a cost/benefit analysis of each of the packages, has yet to be applied. There are two reasons for this. First, we have not yet selected a site or target population; hence, the highly-detailed site-specific cost and market information required for a cost-benefit analysis is not yet available.[1] Second, the combinations of potential packages within a non-site-specific universe are so large as to preclude rigorous economic analysis.

Thus, we have concluded that the only realistic method of dealing with such a large number of potential services and service packages is to look at the several major types of systems and technologies currently available.

This study, then, stops with the estimation of demonstration system costs and the examination of potential services which would be compatible with these technological systems, and concludes that further work along these lines should proceed from a much more narrowly defined service package configuration and specific target populations. However, in Chapter 8.0, we will present a cost/benefit methodology to be exercised in a more selective, site-specific environment.

6.1 Video Tape

In this section we shall describe a system utilizing video tape. Video tape is the primary technology in Service Package A and is suggested as particular components in other packages as well, especially Service Package C, designed to increase community involvement. The hardware requirements include a centralized video tape playback and/or record units at various locations around the city, and facilities for local origination of tapes. The potential users of these tapes would be:

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[1] The level of detail required would include an analysis of the cost components in each relevant conventional service, a study of which specific elements of the service could involve telecommunications, and of the comparative costs of telecommunications and of the comparative costs of telecommunications substitution. In addition, market forecasting of how demand for a service varied as price changed would be required if the nature of price of the service changed. All of the above variables tend to be extremely site-specific. See Chapter 8.0 for more discussion.

- Schools (Service Package E)
- Libraries (Service Package E)
- Community or neighborhood centers (Service Package C)
- Hospitals and health centers (Service Package A and G)

These user agencies would have a number of video tape recorders (VTRs) and TV/receiver monitors to play back tapes, as well as some facilities to originate tapes of a specialized or a limited interest nature.

In addition, the system would include a capability to produce programming of wider interest, either in a central studio or via mobile units for video taping of live events. The term "wider interest" of course is used in the context of service delivery, and specifically excludes commercial or entertainment programming.

The applications defined in this section are intended to discover the potential benefits of video tape technology in a wide variety of situations; further, it is designed to illustrate the maximum potential scope of this technology. As a result, the system incorporates a rather large amount of video tape equipment and facilities.

Two sizeable items are omitted: (1) While the hardware required to implement the system is outlined in this section, no provision is made for the cost of program material or its development. The one exception is the local origination programming; this can be of any level of sophistication consistent with good quality studio equipment, but production costs have not been estimated beyond the allocations of studio equipment and personnel. (2) In addition, user training costs or other transitional costs have not been included in the calculation. These costs would vary by site, number of personnel involved, and the specific application to which the video tape system is made.

In the discussion below, initial cost estimates have been developed for a "typical" city of 100,000 population, and estimated adjustments have been made for population groups of 25,000 and 200,000. It should be emphasized that the above-sized groups may constitute political subdivisions or simply subgroups of a larger city. The analysis suggests that for video tape technology the cost of a system is nearly proportional to community size; thus the equipment and related costs can be extrapolated for any given population figure. The selection of 100,000, 25,000, and 200,000 are for reasons of comparison and convenience.

6.1.1 Video Tape Usage in Schools

The suggested system that would be a major part of Service Package E includes sufficient video tape capability to permit approximately one hour of video tape for each ten hours of classroom time. This should be a reasonable maximum video tape utilization for an initial demonstration, and if the demonstration is successful at this level of utilization, an expanded program could be considered at a later time. The following facilities would be included for the use of schools:

- TV receiver/monitors
- Video tape recorders--cartridge or cassette
- Video tapes including appropriate program material
- Facilities for in-school production of tapes
- Use of local origination studio
- Use of centralized video tape control center (library)
- Use of over-the-air broadcast facilities

In the remainder of this section, estimates are presented of the quantity of facilities required for the above level of video tape utilization in schools. Estimates are presented for population groups of the following sizes:

- 25,000
- 100,000
- 200,000

In most cases the required facilities may be scaled in quantity proportionate to the population served; where scaling is not appropriate, exceptions will be pointed out.

According to the Educational Directory, there are approximately 50 million students in the United States in the range from kindergarten through 12th grade, with an average class size of 27. This corresponds to approximately 24% of a total population of 208 million, or approximately 6,000 students in a population group of 25,000. The number of classrooms required to handle these 6,000 students is approximately 220, which will be assumed to be divided among 10 schools.

The earlier assumption of one hour of video tape presentations for each ten hours of classroom instruction leads to the requirement for one video tape recorder for each ten classrooms. In the present example, the requirement would be for 22 video tape recorders. These units are assumed to be portable, since they must be transported from one classroom to another relatively frequently. It is further assumed that a separate TV receiver/monitor would be permanently assigned to each classroom, since they are heavier, more fragile, and much less expensive than the video tape units themselves.

The number of tape cassettes or cartridges required must be (at most) sufficient to permit showing a different tape to each class each ten hours of classroom time, or approximately one tape every two days. In an average school system there are 180 days in the school year, so the maximum number of tapes required is (180/2) (220 classes) = 19,800 tapes.

The above would be the required number of tapes under the assumption that each tape could be shown only once; this is likely to be an unrealistic assumption, since usually more than one class would be studying the same subject, and could reasonably utilize the same tape. However, since most school systems have relatively consistent scheduling of similar courses in the different schools, the same tape might be simultaneously in demand in all schools presenting the same course. It would seem reasonable therefore to assume sharing of a given tape among classes in the same school building, but not among different schools. For the purpose of this analysis, it will be arbitrarily assumed that each tape can be shared among approximately four different classes; thus approximately 5,000 tapes will be required for the above population group to support a full school year of activity.

In order to provide for the origination of video tapes by the classes themselves, one television camera will be assumed to be required for each school. Since these tapes will usually be experimental in nature, and will not require professional quality, no skilled personnel are needed to operate the equipment.

Finally, it may be assumed that during the course of the school year each class may wish to prepare a 30 minute tape for the use of future classes or simply for the experience and training value of the exercise. Assuming that an additional 30 minutes will be required for preparation and set-up of the taping session, a total of approximately 220 hours of local origination studio time will be required for the preparation of these tapes. This corresponds to approximately 5.5 forty-hour weeks, or approximately 10% of the total studio capacity.

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Population Group of 100,000

For this larger community, most of the above requirements may be scaled upward by a factor of four; hence, a school system containing 880 classrooms in 40 schools would require 88 video tape recorders, 880 receiver/monitors, 20,000 tapes, and the full time services of a librarian at the central video tape library. In addition, preparation of tapes originated by school classes may be assumed to require approximately 40% of the capacity of a local origination studio.

Population Group of 200,000

While again a scaling of a factor of two will probably be adequate to specify most of the required video tape facilities, the above assumptions would lead to approximately full time utilization of the local origination studio. At the level of utilization it may be practical to allocate a separate local origination studio exclusively for the use of the school system, particularly if further experimentation for preparation of program material by teachers is desired. For this example 80% utilization of the local origination studio is assumed.

6.1.2 Video Tape Usage in Libraries

The American Library Association estimates that there are approximately 12,000 central and branch libraries in the United States; this works out to approximately one central or branch library for each 17,300 people. Service Package E suggests use of the library as a video tape center. If it is assumed that each library handles approximately 100 visitors per day, and that 20 of these would utilize video tape facilities, then three video tape carrels would provide approximately 1 1/2 to 2 hours per visitor of video tape viewing.

For a population group of 25,000, one library as discussed above would probably be adequate. A starting collection of approximately 1,000 tapes would be reasonable, expandable perhaps by a factor of two or three if the initial experiments are successful. Cost estimates are provided only for the initial 1,000 tapes. In addition, three tape units are provided for loan to the public on a short-term basis, in the initial phase. Again, no further expansion of this service has been assumed.

The anticipated volume of video tape demand does not appear great enough to require additional library personnel to handle this experiment, although this assumption might be reexamined if the service appears especially popular. The system is assumed not to include the loan of TV cameras to the public, but only video playback/record units. The unsupervised loan of additional sophisticated and expensive equipment to the public should be evaluated in the light of experience with this initial loan program. Also no requirement is identified for local program origination by library personnel.

For a community of 100,000, approximately six library locations would be required, with six video tape units and three receiver/monitor carrels in each. In addition, approximately twice the number of tapes is provided, in order to assure a wider selection for this larger population. Thus, approximately

2,000 tapes would be divided among six library locations. Since each library location might be expected to loan only about 20 tapes each day for in-library use, plus perhaps an equal number for use in the home, no additional personnel are assumed to be required.

A population group of 200,000 would on the average be served by approximately 12 libraries, each requiring approximately six video tape units and three receiver/monitor carrels. A video tape collection of perhaps 3,000 tapes might be reasonable initially. Since the number of tape transactions per library location would be about the same as in the smaller communities, no additional library personnel are assumed to be required. Again, no TV cameras and no local origination studio time are assumed to be required for the library portion of this experiment.

6.1.3 Video Tape Usage in Community Centers

As Service Package C suggests, community centers could provide perhaps the best opportunity for creative use of video tapes by the general public. Such facilities could well have trained, responsible volunteer staff available for the instruction and guidance of members for the public at large in the use of video tape equipment. It would therefore become feasible to provide facilities for experimentation with the video tape medium by various groups. One community center will be assumed to have two tape units, two TV monitors, and two TV cameras. In addition, each community center might be expected to wish to prepare four hours of high quality local origination programming per year, requiring approximately eight hours each of studio time.

A community of 25,000 would be expected to have perhaps five community centers of various types, giving rise to a requirement for ten video tape units, ten receiver/monitors, and ten TV cameras. Each such community center might be expected to require a specialized collection of video tapes (perhaps 50 each), in addition to those which could be borrowed from the public library. The personnel required for guidance of users and protection of equipment are assumed to be either volunteer personnel or paid staff connected with other substantive programs.

The population group of 100,000 is assumed to support approximately 20 community centers, each requireing two video tape units, two TV receiver/monitirs, and two TV cameras. In addition, a specialized library of approximately 50 tapes per community center is assumed for this analysis. A total of 8 hours of local origination studio time for each community center leads to approximately four weeks' total demand, or about 8% of the total capacity of such a studio. It might be noted here that much of the community center use of video facilities would probably occur in the evenings, and hence might not affect the total daytime capacity of the studio. Should the population be 200,000, the required video tape capacity is assumed to increase proportionally and would therefore be twice that described for 100,000

6.1.4 Video Tape Usage in Hospitals

The American Hospital Association estimates that there are approximately 7,000 hsopitals in the United States, which works out to approximately 100 hospitals for each 30,000 people. The average hospital has 60 registered nurses, 31 licensed practical nurses, and 220 beds. There are a number of potential uses for video tape in hospitals (see Chapter 5.0). Since the range of applications of video tape in hospitals is quite diverse, no attempt will be made at this point to relate total video tape utilization to specific site applications. Instead, each hospital will be assumed to have four video tape units, as well as an equal number of TV cameras and receiver/monitors. In addition, the type of equipment necessary for hospital use would be of a higher level of sophistication than that required for many other applications. Hence, high quality cameras, 1-inch tape equipment, and special monitors would probably be required. A specialized library of perhaps 200 tapes is also assumed.

A community of 25,000 might be expected to have one hospital, with the facilities outlined above, while a community of 100,000 might have approximately three hospitals, again equipped as above.

The specialized nature of hospital applications of video tape, combined with the unusual requirements for privacy in many of these applications, suggest that hospitals probably should not share in a centralized video tape library or produce locally originated tapes in a public local origination studio. In addition, the sophistication of hospital-oriented equipment is probably greater than that required for most public use. These considerations suggest that hospital experimentation with video tape is largely a separable operation from the community-wide system outlined previously. While the costs of hospital experimentation are included in this outline, this application has been kept separate from an operational standpoint.

6.1.5 Live Event and Local Origination Programming

Video taping of live events of educational or social service significance would require a multiple video taping unit which could be dispatched to the scene of the event as desired. Such an application is particularly appropriate for Service Package C. A 1-camera mobile unit suitable for this task would cost about $76,500 and and 2-camera unit about $126,500.[1] A full-time crew of three will be assumed to operate the 2-camera unit, and a crew of two will be assumed for a 1-camera mobile unit.

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[1] Mason, William F., et al, Urban Cable Systems, MITRE Corporation M72057, May 1972, page 8-8.

In order to produce the local programming in Service Package C, a fixed studio with high quality equipment is important. The cost and scope of such a studio can cover quite a wide range.[1]

- Minimal studio ($50,000)
- Minimal master studio ($100,000)
- Full professional studio ($600,000 to $1,000,000)

The range of facilities available in such stidios varies over a very great range, and the facilities chosen will depend greatly upon the level of sophistication desired in local origination programming. For the purpose of this study, it will be assumed that a minimal master studio will be sufficient; it will be further assumed that an operating staff of three persons will be sufficient for this studio leading to an annual salary and other operating cost of $45,000 (plus 15% amortization of the $100,000 capital cost), or an aggregate cost of $60,000 annually.

In the event that limited use of a full professional studio is required, it may well be possible to "buy time" from commercial operators of such studios. It will be assumed for the purposes of this study that professional studio time may be purchased at a cost of $200 per hour.

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[1] Mason, op. cit.- p. B-8.

6.1.6 Cost Analysis

The total cost of the video tape systems described for each population group may be obtained by multiplying the facilities required (Table 6.1) by the unit cost of facilities of each type (Table 6.2), resulting in the total costs of the individual types of facilities required (Table 6.3). The total cost of facilities required for each of the three population groups is shown in Table 6.4.

It is clear from Table 6.4 that the dominant cost is that of the video tapes themselves. This category of expenditures would clearly be the best place to look for a potential cost reduction, particularly since the number of tapes required is based largely upon arbitrary assumptions. Since the present analysis is not site-specific, these assumptions have been used in place of the rather detailed specification of requirements for tapes which would accompany an actual demonstration design.

The foregoing should be considered only a broad outline of the types and amounts of expenditures necessary for these systems. A demonstration design would necessarily take into account detailed costs such as storage space for tapes (assuming that the particular community in question would make a charge for this), the proportion of volunteer time and paid employee time allocated to the demonstration, costs associated with institutional cross-support, provision for maintenance and repair of equipment, etc.

VIDEOTAPE SYSTEMS--POPULATION GROUP OF 25,000

User	VTR's	RCVR/ Monitors	Tapes	TV Cameras	Library Personnel	Studio Time	Broadcast Time
Schools (10)	22	220	5,000	10	0.25	10%	10 hours
Libraries (1)	6	3	1,000	0	0	0	0
Community Centers (5)	10	10	250	10	0	2%	10 hours
Hospitals (1)	4	4	200	4	0	0	0

TABLE 6.1 (1)

FACILITIES REQUIRED

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VIDEOTAPE SYSTEMS--POPULATION GROUP OF 100,000

User	VTR's	RCVR/ Monitors	Tapes	TV Cameras	Library Personnel	Studio Time	Broadcast Time
Schools (40)	88	880	20,000	40	1.0	40%	40 hours
Libraries (6)	36	18	2,000	0	0	0	0
Community Centers (20)	40	40	1,000	40	0	8%	40 hours
Hospitals (3)	12	12	600	12	0	0	0

TABLE 6.1 (2)

FACILITIES REQUIRED

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VIDEOTAPE SYSTEMS--POPULATION GROUP OF 200,000

User	VTR's	RCVR/ Monitors	Tapes	TV Cameras	Library Personnel	Studio Time	Broadcast Time
Schools (80)	176	1,760	40,000	80	2.0	80%	80 hours
Libraries (12)	72	36	3,000	0	0	0	0
Community Centers (40)	80	80	2,000	80	0	16%	80 hours
Hospitals (7)	28	28	1,400	28	0	0	0

TABLE 6.1 (3)

FACILITIES REQUIRED

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TABLE 6.2

UNIT COST OF FACILITIES

TAPE EQUIPMENT

TYPE	UNIT COST	TAPE CAPACITY	COMMENTS
1/2" Cartridge VTR	$ 1100	30 min.	non-broadcast
1/2" reel-to-reel VTR, incl. camera, battery, + ac adapter (portable)	1700	30 min.	non-broadcast
3/4" Cassette VTR	1300	60 min.	non-broadcast
1" Cartridge VTR	2200	60 min.	color-playback only (non-broadcast)
	2600	60 min.	b+w-play/record (non-broadcast)
	3000	60 min.	color-play/record (up to $16K-$32K for full professional capability) *broadcast capable
Cameras	450-1200		
Receiver/Monitors	200		b+w
	750		color
Tapes 1/2" Cartridge	23	30 min.	
3/4" Cassette	25	30 min.	
	35	60 min.	
1" Cassette	40	60 min.	cartridge ($10) + standard roll of tape ($30)
Production Console	8,000		2 cameras, 3 monitors, plus associated equipment

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VIDEOTAPE SYSTEMS--POPULATION GROUP OF 25,000

User	VTR's	RCVR/ Monitors	Tapes	TV Cameras	Library Personnel	Studio Time	Broadcast Time
Schools (10)	$24,200	$44,000	$230,000	$ 4,500	$3,000/yr.	$6,000/ yr.	$2,000/yr.
Libraries (1)	$ 6,600	$ 600	$ 46,000	0	0	0	0
Community Centers (5)	$11,000	$ 2,000	$ 11,500	$ 4,500	0	$1,200/ yr.	$2,000/yr.
Hospitals (1)	$12,000	$ 3,000	$ 8,000	$ 4,800	0	0	0
TOTALS	$53,800	$49,600	$295,500	$13,800	$3,000/yr.	$7,200/ yr.	$4,000/yr.

TABLE 6.3 (1)

COST OF FACILITIES REQUIRED

VIDEOTAPE SYSTEMS--POPULATION GROUP OF 100,000

User	VTR's	RCVR/ Monitors	Tapes (000)	TV Cameras	Library Personnel	Studio Time	Broadcast Time
Schools (40)	$ 96,800	$176,000	$ 920	$18,000	$12,000/yr.	$24,000/ yr.	$ 8,000/ yr.
Libraries (6)	$ 39,600	$ 3,600	$ 92	0	0	0	0
Community Centers (20)	$ 44,000	$ 8,000	$ 184	$18,000	0	$ 4,800/ yr.	$ 8,000/ yr.
Hospitals (3)	$ 36,000	$ 9,000	$ 24	$14,400	0	0	0
TOTALS	$216,400	$196,600	$1,220	$50,400	$12,000/ yr.	$28,800/ yr.	$16,000/ yr.

TABLE 6.3 (2)

COST OF FACILITIES REQUIRED

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VIDEOTAPE SYSTEMS--POPULATION GROUP OF 200,000

BEST COPY AVAILABLE

User	VTR's	RCVR/ Monitors	Tapes (000)	TV Cameras	Library Personnel	Studio Time	Broadcast Time
Schools (80)	$193,600	$352,000	$1,840	$36,000	$24,000/yr.	$48,000/ yr.	$16,000/ yr.
Libraries (12)	$ 79,200	$ 7,200	$ 138	0	0	0	0
Community Centers (40)	$ 88,000	$ 16,000	$ 368	$36,000	0	$ 9,600/ yr.	$16,000/ yr.
Hospitals (7)	$ 84,000	$ 21,000	$ 56	$33,600	0	0	0
TOTALS	$444,800	$396,200	$2,402	$105,600	$24,000/yr.	$57,600/ yr.	$32,000/ yr.

TABLE 6.3 (3)

COST OF FACILITIES REQUIRED

ITEM	25,000 Population		100,000 Population		200,000 Population	
	Capital Cost ($)	Annual Cost ($/year)	Capital Cost ($)	Annual Cost ($/year)	Capital Cost ($)	Annual Cost ($/year)
VTR's	$ 53,800		$ 216,400		$ 444,800	
RCVR/Monitors	49,600		196,600		396,200	
Tapes	295,500		1,220,000		2,402,000	
TV Cameras	13,800		50,400		105,600	
Library Personnel		$ 3,000		$12,000		$ 24,000
Studio Time		7,200		28,800		57,600
Broadcast Time		4,000		16,000		32,000
TOTALS	$412,700	$14,200/yr.	$1,683,400	$56,800/yr.	$3,348,600	$113,600/yr.

TABLE 6.4

TOTAL COST OF FACILITIES REQUIRED

VIDEOTAPE SYSTEMS

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6.2 Teleprocessing Systems

The most applicable telecommunications system presently available for social service delivery is the teleprocessing system; that is, a combination of computer and communications technologies. Such systems are directly applicable to Service Packages B, D, F and G. The number of possible combinations of these two technologies is very large, and the number of possible service delivery modes based on these combinations is larger still. The available computing equipment for the packages ranges from the programmable microprocessor to the mini-computer with a wide variety of peripheral equipment, and up to the large general purpose computing facility. Available communications facilities range from a simple telephone with voice communication to dial-up or leased line data communication, to broadcast television, to one-way or two-way cable television with frame stoppers and full alphanumeric keyboards. All of these have been used in demonstrations at one time or another, and could be used to provide particular services within the proposed service packages.

It is clear that a large number of possible combinations of services within the packages can exist. Further, the large number of diverse experiments presently underway have been planned individually, and have been based upon widely varying implementations, even where the basic technologies for guidance on the planning of an integrated demonstration, the great diversity of hardware types makes it difficult to place them in a compatible format.

Yet it is clear that a common format for demonstration experiments can yield considerable advantages. The potential economies of scale inherent in a community-wide demonstration covering a wide range of services is a major motivation. In addition, an integrated demonstration can lead more easily to the type of coherent "package" which could be replicated for the benefit of communities all over the country. Also, there are significant potential synergistic benefits resulting from the simultaneous use of advanced technology in a wide variety of social and municipal activities.

The above considerations would seem to place a high priority on the development of a common hardware format and terminology, to use as a basis for comparison and integration of potential services

There are two really major teleprocessing demonstrations existing today: TICCIT and PLATO IV. Both are experiments in Computer Assisted Instruction, the former using CATV communications and the latter leased telephone lines. Either system would appear to provide a reasonable departure point for an integrated demonstration, although the proportion of CAI could of course be substantially changed. It must be emphasized that the packages which have been suggested in this report are quite different from the original TICCIT services, and the actual implementation and operation of the systems may be different as well. Also, in come cases the system may be augmented by other telecommunications equipment for communications channels. The general approach to this section, then, will be to describe two versions of the TICCIT system, and then to suggest certain additional hardware configurations based upon these and other technologies that would be appropriate for our packages. Some existing demonstrations of various kinds will then be outlined in terms of their compatibility with these packages.

6.2.1 TICCIT DEMONSTRATION SYSTEM (Two-Way Interactive CATV)

The TICCIT system consists of a combination of computer and cable television technology, designed for delivery directly to subscribers' homes. The technology corresponds with that suggested in Service Package F. The basic system uses dual minicomputers combined with two-way CATV and centrally located "frame stoppers" or refresh devices. These frame stoppers permit the central computer to address a single frame of cideo information to any subscriber as required. The basic system has a capacity of 1,000 subscribers, of which approximately 120[1] may be active at any one time. The system permits delivery of one-way video programming as well as individual frames to any subscriber, and it permits the subscriber to return limited amounts of digital data to the central computer at will. The home subscriber can be equipped with data input terminals of varying capability, ranging from a three-button polling terminal up to a full alphanumeric keyboard. Sophisticated interactive applications are thus possible, and a considerable amount of CAI and other software has been developed for this system.

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[1] Assumed for this analysis, in order to make the system more comparable in capacity to some of the other packages. The actual TICCIT demonstration calls for 60 to 90 ports.

Other services deliverable with the TICCIT Demonstration System are home alarm and meter monitoring, various commercial services, remote data retrieval, remote computation (limited), and digital data return to the headend (limited amounts). The system is also capable of returning a computer-generated audio response to the subscriber, in response to digital inputs via the home keyboard.

A demonstration of this form of the TICCIT system is currently proposed for Stockton, California.

6.2.2 TICCIT CAI SYSTEM (Two-Way Institutional Interactive)

This version of the TICCIT system is designed for use primarily in a single location and the hardware corresponds, to a large degree, to that required for ervice Package E. It uses a central refresh system as in the demonstration outlined above, but no CATV or other communication channels are provided. The system uses 120[1] modified TV receivers combined with full keyboards for student terminals; these are connected by wire to the central computer, and must be no further away than about 1,500 feet. As above, the system uses dual mini-computers, in this case optimized for CAI delivery, and includes a capability for single frame video, automatic audio response, and substantial digital data return to the computer. No home subscriber services are provided.

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[1] Reduced in this study from the specified 128 ports, for comparability with other packages.

6.2.3 One-Way CATV with Dial Access to Computer

This system is the technology most appropriate for Service Package D. It is based upon an assumed pre-existing one-way CATV system, which is then augumented by a central computer system and an interface with the public switched telephone network. It is assumed that the demonstration would lease one-way CATV channels from the cable system operator, and provide the computer and its interfaces. Cablecasting would be provided over the leased lines to all CATV system subscribers, although special interest programming could of course be included. Any subscriber could access the central computer facility via a tone-type telephone in his home, and enter limited amounts of digital information into the computer by means of the push-buttons. The computer in turn could respond over the telephone line to the subscriber by means of an automatic computer-controlled audio response system. The subscriber-computer interaction could be either in response to cablecast programming or at the spontaneous wish of the subscriber.

In addition, educational and social service institutions in the community would be equipped with teleprinters, connected to the central computing facility via leaded telephone lines. These teleprinters could be used to retrieve a substantial amount of data from computer memory, to perform substantial amounts of remote computation and data manipulation, and to enter substantial amounts of digital information into the data bank. In addition, the computer could store information entered at one teleprinter and retransmit it to another, providing a switched teleprinter communications network.

If the home subscriber is unable to obtain sufficient information or assistance via dial access to the computer, he may instead telephone to one of the participating agencies having a teleprinter. The teleprinter operator could then obtain more comprehensive data directly from the computer, and either directly assist the subscriber or refer him to the proper individual or agency for additional assistance.

6.2.4 One-Way Public CATV with Two-Way Institutional Interactive CATV

This system is also based upon a pre-existing one-way CATV system for public use and is an alternative system for Package G. It assumes that channels are available for lease from the CATV operator for demonstration purposes, including point-to-point channels for interconnection of social service institutions. It is assumed that the point-to-point leased channels would have one-way capability, but would be arranged in a closed loop so that any institution connected to the loop could communicate with any other. These are of course special assumptions, although two-way cable could be installed if necessary. Additional facilities include television cameras at the CATV system headend (for cablecasting) and at various social service institutions in the community. A larger number of institutional locations are provided with small digital response keyboards for use in entering small amounts of data into the central computer facility, and with microphones for audio communication with other such locations.

Services which could be provided with this system include cablecasting to the homes of all CATV system public subscribers, audio/video conferencing and consultation among social service personnel and members of the public who are physically present at institutional locations, and limited digital response to the central computer facility from these locations. Since no teleprinters or single frame video devices are included in this system, substantial remote data retrieval would not be possible.

6.2.5 Two-Way Institutional CATV

This system for Service Package G would be a two-way dedicated point-to-point CATV communications system for institutional use only. The system would be constructed and owned by a consortium of social service delivery institutions or by the local community government. It would include up to 30 dedicated point-to-point CATV channels for interconnection of these facilities. Television receivers would be provided at a number of these locations, along with television cameras and microphones. The principal use of this system would be for audio/video conferencing and consultation among social service administrative and delivery personnel and members of the public who are physically present at institutional locations.

6.2.6 Two-Way Institutional Interactive CATV

This system is much like the one immediately preceding, except that it has been augmented by interactive terminals and a teleprinter network. This system would permit fully interactive CATV services at a limited number of primary institutional locations, and more modest interactive services at a larger number of secondary locations. All locations would be capable of remote data retrieval and remote computation via teleprinters connected to the central computing facility, would be capable of returning substantial digital data to the facility, and could also communicate with one another via a switched store-and-forward mode using the teleprinters. The primary locations would in addition be capable of CAI-type interaction, including single frame video reception. As with the preceding system, audio/video conferencing and consultation among institutional locations would be possible at both primary and secondary locations. This system, as above, is assumed to be installed and owned by either an institutional consortium or a local community government.

6.2.7 System Summary and Cost Analysis

Table A (Appendix B) presents a brief outline of the functions associated with each of the above systems. Table B (Appendix B) presents a list of system components and subsystems which have been assembled into the above systems. The estimated purchase cost and associated annual costs for each component or subsystem have been included. The cost data presented in this table have been extracted from publications on the TICCIT system and from current industry pricing information. In some cases the subsystems or components referenced are developmental in nature, or do not exist at all--in these cases best estimates have been used. As a result, while these data are useful as inputs to a comparative cost analysis and to budgetary estimates, they should not be regarded as precise engineering cost specifications.

It should be noted that estimated maintenance and operating costs are included in Table B on an item-by-item basis, rather than added in at the end of the analysis on a system-wide percentage basis. Although this results in some arbitrary and sometimes artificial assignments of these costs to the individual components and subsystems, it allows considerably more flexibility in the subsequent cost analysis. As a result of this approach, it is possible to add or delete a given component or subsystem, and adjust the total system cost, by simply adding or subtracting two numbers: the capital cost and the associated operating cost.

Table C (Appendix B) is a checklist of the components and subsystems from Table B which are necessary to comprise the above systems. In some cases fractional quantities are used in this checklist. This has been done for two reasons: either a particular system requires a component which can be smaller or less capable than the "standard" one listed in the checklist, or a smaller amount of a divisible item is required.

It should be emphasized that the factors listed in Table C are included for costing purposes only, and in some cases represent best estimates of cost percentages. This approach, while not precise enough for a detailed engineering specification, makes the subsequent costing procedure far more manageable.

Table D (Appendix B) contains an estimate of the total cost of each of the systems specified in Table C, obtained by multiplying the individual component and subsystem costs in Table B by the number of each specified in Table C.

A comparative summary of system configurations is given in Table E (Appendix B).

6.3. Analysis of Other Service Delivery Systems

6.3.1 Service Referral

In many cases a citizen needing social service assistance encounters considerable difficulting in locating the proper agency to help him, and in obtaining the necessary information or assistance. This results from the large and diverse number of social service agencies and programs, and from the citizen's likely unfamiliarity with the procedures required. Telecommunications technology is presently being used to reduce this confusion.

The Model Cities Community Information Center in North Philadelphia has been offering a service referral arrangement to local citizens. This project uses a computer to store information on approximately 1200 agencies and programs offered to local citizens. When a citizen telephones to the service referral project for assistance, an operator listens to his request and then enters it into a computer terminal. The computer then displays on a cathode ray tube information concerning those available services which would be most likely to meet his need. The display includes information about the details of the service and telephone numbers for further information. If necessary, the operator, may telephone the actual social service agency over a conference circuit, with the citizen still on the line, to assure that he is properly assisted.

The system as constituted in North Philadelphia serves government and non-profit social service agencies, such as those assisting with food, housing, employment, etc. For each agency or program, the computer stores and displays information such as:

- Branch and area served
- Ages served
- Hours open
- Language capabilities (e.g., Spanish)
- Availability of facilities for the handicapped
- Educational requirements
- Sex requirements
- Waiting time
- Intake procedures
- General description of service
- Contact person and telephone number

In the present operational mode of this demonstration, the operators rely heavily on the three-way conferencing capability and rather lightly upon the computer. Of the 60 inquiries on a typical day, the operator refers to the computer data bank only about six times. The demonstration as presently constituted is therefore highly labor-intensive (four operators handling calls) and it would appear that the full potential benefit of the computer data bank is not realized. Additional benefits of this computer facility are the opportunity to update stored information on a regular basis, to permit persons unfamiliar with the details of social services to work as clearinghouse operators, and to permit "browsing" as a training aid for social service personnel.

The system uses a Hewlett-Package 2000C computer, having 32K words of main memory and an 11 million byte disc. The system has a capacity of 32 active ports, of which four are used for this service. Each operator (port) is equipped with a cathode ray tube display and a printer terminal and keyboard. Approximately 1/3 of the disc memory is assigned to this service; approximately 630 characters of information are stored for each of 1200 records (agencies or programs). The community population served by this data base is approximately 100,000; it is estimated by project staff that approximately 3,000 to 5,000 records would be required for city-wide coverage.

The computer-related cost of this demonstration is approximately $32,000 per year including:

- Programmer

- Keypuncher
- Rental of four computer ports and disc

The total agency budget of $250,000 per year includes:

- Four operators
- Administration/management
- Overhead

This system or variations of it could be implemented under Service Package B, the Referral Data Bank. With the two-way public interactive CATV system, any two-way CATV susbcriber could access the computer directly on his television screen. He could "browse" at will through the service descriptions stored in the data bank, and could in this way determine which agency and which program would be most appropriate to serve his needs. Since the telephone number and contact person for the particular services could be stored and updated in the service description, he would be able to telephone directly to the proper place for assistance.

This type of service could also be implemented on a one-way public CATV demonstration, in which the citizen could dial directly into the computer via his tone telephone and enter digitally his request for information. In this case, the amount of information which he received in return would be somewhat more limited, and would come via an automatic audio response device. Browsing would be more difficult and more time consuming, and too much of it would tie up the limited number of audio response system ports.

Finally, this service could be implemented on a two-way institutional-interactive CATV system in much the same manner as in the currently existing demonstration in North Philadelphia. In this case, operators would be provided to receive telephone calls from citizens and to operate the central refresh terminals and access the computer.

6.3.2 Social Service Management

A greater degree of computer assistance to social service delivery is currently being demonstrated in the city of Chattanooga, Tennessee. In this demonstration, an applicant for social service assistance visits a neighborhood service center and fills out a brief application form. A social service counselor then keys this information into a cathode ray tube/keyboard terminal, thereby entering his information into the computer. The applicant then describes his particular problem to the counselor, who selects a specific agency and receives a display indicating the services provided by that agency. Next the counselor selects specific services required by the applicant, and requests and receives a printed output which is called a Client Agency Service Plan, including both information about the client and about the service desired. The client takes this plan with him in a radio-dispatched van, provided by the city, to the selected agency for service.

In this system, the computer is also used to produce a follow-up reminder to a staff social worker and to store and analyze anonymous comments on service quality from service applicants.

With the exception of the mobile vans, the implementation of this system is quite similar to the North Philadelphia system. The computer appears to be used more fully, such as for follow-up reminders, storage of applicant data and analysis of comments, but the required hardware is much the same. The cost of this system is approximately $100,000 per year for computer usage, plus an equivalent amount for personnel costs. This social service management activity, like the service-referral described above, could be implemented as part of Service Package B through two-way interactive CATV, one-way public CATV with dial access to computer, and two-way institutional interactive CATV.

6.3.3 School Teleprocessing System

An interactive teleprocessing system is being used for several purposes by the Fairfax County, Virginia school system. This system uses terminals connected to two mini-computers to assist students in solving mathematical problems, to give them hands-on experience in high school level computer courses, and to demonstrate experimental computer-assisted instruction at an elementary school. The system is also used to schedule and control distribution of movie films to all of the 167 schools within the County, comprising a daily shipping and receiving volume of 1,000 films; order processing of library acquisitions are also automated to a certain extent.

The system consists of two Hewlett Packard 2000F computers, each having an 8K word communications processor, a 32K job processor, 32 ports, one disc drive (23.5 million bytes of storage), and one tape drive used for back-up and systems functions. In most cases dial-up lines are the primary communications channel, but leased lines are used in certain cases. In some schools the problem of unauthorized use of the telephone became so severe (e.g., unauthorized long distance calls, unauthorized dial access to other computer systems) that leased lines were installed to eliminate these problems. Type ASR33 teletype terminals are used exclusively in the schools for student purposes, although the film distribution application discussed above is implemented with CRT displays.

A service similar to the one currently demonstrated in Fairfax County could be implemented easily on the comprehensive two-way institutional interactive system, (the TICCIT CAI system). In this case, the students would have CRT display panels instead of teleprinters, but the system would be functionally equivalent. The TICCIT CAI programming is probably more extensive than that employed by Fairfax County, but this is a qualitative difference. The TICCIT CAI system, however, requires that all terminals be located within 1,500 feet of the central computer complex, which would restrict access to a single school.

This type of demonstration could also be implemented by the comprehensive one-way plus dial access computer system, using the teleprinters and leased lines provided. These teleprinters could be shared among students and social service delivery personnel, for example, The Fairfax County CAI demonstration could also be implemented on comprehensive two-way institutional interactive CATV system, using either the teleprinters or the central refresh terminals.

6.3.4 Computer-Assisted Laboratory

A computer-controlled medical laboratory is being demonstrated by the Youngstown Hospital Association in Ohio. This system permits a physician to request laboratory tests from any tone-type telephone. The physician dials the appropriate telephone number for the computer, and then enters numbers identifying the patient and the requested test. The computer responds via an automatic voice response unit, confirming the identity of the patient and the particulars of the requested tests. The computer then prints an order label for the specific test required. Some of the laboratory procedures are themselves automated, and some are conducted by laboratory technicians. In either case, the results of the tests are entered into the computer, and are available to the physician via his tone telephone and the audio response unit. The advantages of this system are the opportunity for the physician to enter requests and receive laboratory results from any convenient telephone, the instant response from the computer to verify the request and thereby avoid mistakes, and the releasing of personnel from the time-consuming task of laboratory test bookkeeping. This laboratory test order processing service could be implemented on a comprehensive one-way CATV system using computer dial access (Service Package D).

6.4 Additional Considerations

6.4.1 The Incidence of Costs

The question of how much any particular component or subsystem might cost is a technical one, and hence is a proper subject for this study. Cost estimates have been presented for a substantial number of possible system components, including some which are not specified for inclusion in any of the system configurations outlined (this was done in order to permit the reader some additional flexibility in "constructing" alternate systems which might interest him). The question of who will pay the cost is however a political or programmatic one, and will not be treated at this stage in the study. The question of who will pay the cost of connection of a poor person to a CATV system, or who will pay the extra cost of tone-type telephone service for him, is a matter for program planners and social service administrators; the costs of such items have been included in Table B (Appendix B) in case it is desired to add them into the demonstration cost at a later time.

6.4.2 System Capacities

The systems outlined in this study are in some cases substantially different from one another, and comparison of system capacities is somewhat difficult. In addition, at least two of the systems serve both a large number of public subscribers at home, plus a more limited number of social service personnel and members of the public in institutional locations. Allocating the system cost among these diverse users is a difficult undertaking, particularly when comparisons are to be made between different systems which may deliver some (but not all) of the same services.

The above considerations are principally of interest in the comparison of hypothetical alternative systems, as in the present study. Another point must be made, however, with respect to the additional question of optimization of any one of these systems, the question of degree of utilization of system capacity. Even if it were meaningful in any specific case to calculate the cost of a system in terms of dollars per port minute plus dollars per equipped subscriber (for example), the optimization of any single system requires full utilization of its capacity. It must be pointed out that the present study does not include a complete definition of the services and service utilization required to load the system fully.

6.4.3 Subscriber Penetration

One of the important variables in the analysis of profitability of CATV systems is the subscriber penetration; that is, the number of subscribers actually connected to the system as a percentage of those who are accessible to the cable. Where necessary in this study, an assumption of 30% has been used for subscriber penetration.

6.4.4 Rate of Return

Where necessary in the calculation of the cost of CATV channels or other facilities, an average CATV system rate of return of 12% has been assumed.

6.4.5 Costs of Developmental Equipment

Some of the equipment for which cost estimates are presented in this study is still developmental in nature. The costs quoted in the literature (and in this study) are therefore very rough. This is due to two subsidiary reasons:

- The final configuration of the equipment is unknown, so the design cannot be costed accurately
- The ultimate market is unknown, so the apportionment of development cost to unit price is subject to negotiation

It is unfortunate that perhaps the largest single cost item referred to in this study (although not exactly hardware) falls into this category--the estimated cost of "courseware" for CAI and other interactive systems. These costs are therefore both large and highly variable.

6.4.6 Maintenance Allowances

Substantial allowances have been made for spare parts, test equipment, etc., since the demonstration configuration imposes a variety of conditions and demands upon the equipment. In particular, more maintenance expense has been allowed for the TICCIT CAI system than is specified by Mitre Corporation in its descriptions of this system, under the assumption that the demonstration environment would be different from that of a working system. In some cases, the allocation of spare parts to a particular subsystem may appear artificial, but an attempt has been made to include all potential supporting costs in the cost of each subsystem, to facilitate their linear addition into complete system costs. Spares and other allowances are:

- CATV Headend equipment spares--10% of capital cost
- Computing equipment spares--10% of capital cost
- Terminal equipment spares--5% of capital cost
- Terminal equipment maintenance staff--10% of capital cost per year
- Test equipment--5% of capital cost
- Miscellaneous (shipping, sales texas, etc.)--10% of capital cost

6.4.7 Scramblers

Scramblers have often been mentioned as a means of insuring transmission to the appropriate user. It is fairly well accepted that the proliferation of central data handling systems containing information of a private or personal nature for large numbers of individuals have considerable potential for mischief. Probably no group of potential designers of a data processing system would be more likely to care about this issue than would social service planners. But the types of scramblers or other privacy-assuring devices required for some of the systems outlined in this study, while clearly feasible, have in some cases not been designed. Even some of those which have been designed have not been produced in economic quantities. Furthermore, a variety of different approaches to privacy are possible, and all have not been sufficiently explored. As a result, no attempt has been made in this study to estimate the cost of privacy protection, beyond the "provision for privacy" listed in Table B. This latter item represents simply the cost of locating the "framestoppers" of a system such as the TICCIT demonstration system outside the subscribers home, where access to information concerning others would be more difficult to obtain. This is by no means the only (or the best) approach to privacy protection, and indeed would not be applicable to some of the other systems. Without any attempt to minimize the importance of this issue, let us simply suggest here that any projected demonstration should include the development and implementation of means for protection of privacy as one of its principal objectives.

6.4.8 Costing Systems Versus Designing Systems

It is probably obvious that assembling a working system is much more complex than simply ordering the parts and components checked and plugging them together. While the approach of linear addition of components employed in this study is useful for costing purposes, it ignores necessary equipment and expenses for subsystem interfacing, system integration, etc. Inclusion of all of these in detail would be necessary for specific system design in demonstration sites.

7.0 INSTITUTIONAL RELATIONSHIPS AND CONSTRAINTS

7.1 The Institutional Interface[1]

In examining the institutional relationships involved in the introduction of integrated service delivery through the service / technology packages described in Chapter 5.0, one must first look at the institutional resistance to such an introduction. That is, what resistance will these service packages encounter from existing institutions and institutional personnel? On the other hand, one must also look at the nature of institutional acceptance (passive) or institutional change (dynamic, where the institutions feel that the application of telecommunications enhances their overall effectiveness and thus becomes a stimulus for institutional development and growth.

In this section, institutional constraints are viewed from two vantage points with two objectives. First, what are the institutional constraints that are so pervasive as to make telecommunications unworkable and thus preclude the demonstration of a given service delivery package in that particular setting? Thus, in this instance, institutional constraints served as one of the methodological tools by which service delivery/telecommunications packages were selected and refined. The second vantage point has to do with the relative degree of constraints imposed upon an attempt at implementation, thus requiring particular approaches in order to circumvent the constraints and make the demonstration a success. The distinction here is that no demonstration design will be implemented in a void and no amount of planning or site selection will result in the absence of some institutional resistance of one sort or another. The critical issue is whether the inability of the institution(s) to change is so extreme as to make the demonstration infeasible.

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[1] Many of the institutional constraints and considerations presented herein are based on two meetings of a Telecommunications User Advisory Committee (TUAC). This committee was created and convened by an Abt Associates subcontractor, Public Technology, Incorporated, to identify in general terms those social services that should be considered for experimental delivery. The TUAC also discussed several concerns and constraints regarding this method of social service delivery, which affects institutions, their clients, and the general population. Committee membership included medical personnel, social service administrators, social service planners, computer and telecommunications experts, educators, minority representatives, and local government administrators. (See Appendix A for a listing of participants on the Committee.)

However, the potential of institutional cooperation has also been considered in developing the demonstration design and subsequent service packages. Too often, opportunities for cooperative interaction between institutions and possibilities of networking and sharing of costs and resources are overlooked through too heavy a focus in the planning phase on overcoming anticipated institutional resistance that never materializes.

The removal of institutional constraints involves major policy issues and these are discussed in detail in Section 9.0. Yet, there are operational implications of these constraints for the success of a demonstration. Close scrutiny of the patterns of institutional relationships has to be performed for user/institution behavior (e.g., service recipient/service institution) differs from hierarchical institutional behavior, (e.g., municipal government municipal public service agency) which in turn differs from the behavior patterns of institutions with parallel interrelationships (e.g., university/university).

There are several general institutional constraints that will be encountered in establishing and implementing a demonstration, regardless of whether the demonstration focuses on aspects of health, education, or other social services. These constraints can be broadly categorized into six overlapping areas of consideration. These areas are:

- organizational considerations;
- territorial considerations;
- personnel considerations;
- information considerations;
- economic considerations; and
- service product considerations.

By far the broadest area of considerations has to do with the organizational constraints related to institutional acceptance of new service delivery modes. Of immediate concern are the changes required by the institution(s) in their general day-to-day management and supervisory procedures. There is the problem of the human element with personality conflicts resulting from the interaction of "traditional" service deliverers with the new breed of "communications" providers. Long-standing political linkages may be threatened, and there is often the tendency to protect built-in constituencies. In addition, there can be the related problem of which group will take the lead role in determining how the new system is utilized.

This leads to territorial considerations, or the "us" vs. "them" syndrome. Clearly, new telecommunications technology applied to service delivery will require differing types of individuals, many of whom will be new to the existing institutions and, in many instances, new to the geographical area. Such transmigration could have great cultural implications and influence on personal life style in particular communities. This would be especially true in rural areas, where the influx of new telecommunications service delivery will invariably imply new and different faces living in these areas.

Personnel considerations are most directly manifested in unions and other trade associations and organizations. The tendency to protect one's interests through group cohesion is not new, and a major constraint to several previous attempts to introduce new technology in telecommunications as well as other fields has been the resistance of the unions to what they feel might be a threat to their economic survival. Furthermore, the professionals involved in service delivery in the traditional way are not immune to concern with rapid technological change. Lack of complete understanding of the new telecommunications applications, a feeling that their skills may not be readily transferable, and a need to learn new management techniques to meet the needs of the new technology and new personnel may cause the professionals in some cases to impose institutional barriers to the demonstration.

Information considerations deal primarily with the need to establish adequate "protocols" to be employed in using the new system of service delivery. Such protocols would have to take into consideration the question of "communications etiquette" that would have long been established in the institutions. Another aspect of the information would be its ability to be translated into "common language" for those individuals who are unfamiliar with the lexicon of telecommunications technology. Finally there is the everpresent question of developing procedures that limit or control the availability of client information for the protection of both the client and the service delivery institution involved.

Economic considerations range from the problem of restructuring wage scales to correspond to the redefinition of job roles and responsibilities that would result from the telecommunications service delivery system to the problem of "copyright" or residual payment of stored software material. One can envision problems of primary ownership of such programming as videotaped educational lectures; taped job training curricula, etc. Lastly, the actual payment methods, both of salaries and third party payments to service providers, could prove to be institutional barriers. The example of some physicians avoiding Medicare or Medicaid patients due to the lag-time involved in obtaining reimbursement and the additional paper work involved might be multiplied in a system of integrated service delivery of a range of public services paid for through a variety of third party methods. These constraints would affect all service packages in which new salary structures or third party payment is involved.

Service product considerations raise several important issues of potential institutional constraints. The most widespread is the issue of accreditation of certain personnel in the delivery of the services. A much discussed example is the problem of physician extenders utilizing telecommunications technology to provide medical services that previously fell under the purview of the physician himself. (Such a Service is suggested in Service Package G.) Medical accreditation is done at the state level, and these states are looking closely at determining the point at which medical services provided by the para-professional exceed his or her ability and training to provide such services. Although the communications system establishes a link between the para-professional and the physician, it also introduces a broader definition of the service product, and the problem becomes the application of professional medical standards for "non-standard" service products. Associated with this concern is the "clien reception" of the service the "training" or "consumer education" necessary to achieve client acceptance, and the "costs" associated with the change in the service delivery mode in terms of client orientation and service level expectations. What is involved, particularly in the health field, is the transition of critical functions and the way in which both institutions and service recipients will respond to and participate in this transition.

Aside from the basic institutional constraints discussed above, there will be various jurisdictional, legal and regulatory constraints imposed on the HEW telecommunications experiments. Obviously a major set will be those imposed by the Federal Communications Commission (FCC). The FCC rules affect broadband cable television, telephone, and over-the-air broadcast transmissions. Therefore, the cooperation of this federal agency will be a basic requirement.

In addition to the FCC there will be constraints imposed by state public utility commissions and local municipal or county governments. The issues surrounding municipal franchise authority with respect to cable television have been well publicized following the FCC Report and Order on CATV in February, 1972. A further complicating factor is that local laws may require undergrounding of all cable lines. In large urban centers these laws are the rule, rather than the exception. The constraints go beyond just the franchise authority and local public works law. In addition there will be questions raised regarding fee structures. If in fact the proposed demonstrations result in marketable services, one can expect that fee structures will become a major issue.

In the previous section, constraints have been discussed in a general way. In the next sections, institutional constraints that are specific to health, education or social services are presented to provide some illustration of the vast array of institutional variables that must be examined in planning site-specific demonstration efforts of the service packages outlined.

7.2 Institutional Constraints in Health Services

The specific institutional constraints for health services conform to a great extent to the generalized areas of constraints previously discussed. These constraints in health may be classified into constraints imposed by the professional medical community; constraints imposed by changes in the role of the physician, the non-physican, and the client through the introduction of the telecommunications delivery system; constraints imposed by changes in the payment structures for services provided by the non-physician or services provided through telecommunications in a "non-traditional" way; and constraints that are organizational and fiscal in nature. (These constraints will be encountered in both Service Packages A and G.)

As in the other professions (and possibly more so), there has been and will continue to be strong resistance from individual physicans and their representative organizations to what they feel are untested technological applications in an area where the margins of error could mean the life or death of the patient.

Therefore, it is important that telecommunications demonstrations in health be introduced in such a way that no additional margin of error in diagnosis or treatment occurs.

Potentially, telecommunications may be used to increase the accountability of the health professional, thus reinforcing the standard of quality of health care, not detracting from it. For example, as teleconsultation enables a health professional to gain easy access to the opinion of other professionals, the reliability of diagnoses should increase. Another more controversial means of increasing professional accountability is by recording medical procedures for self-assessment by the professional involved and to be viewed by students. A record is then created, which might conceivably be used against the health professional as well as to his or her advantage. In this case, the increased accountability afforded by telecommunications technology might constitute a threat to the security of a profession which has traditionally functioned without checks and balances, except in most unusual situations. In terms of constraints imposed by the nature of the medical profession, this ability to bring medical procedures out from the home or operating room and onto a television screen constitutes the greatest threat to the professional.

There are several means of responding to these issues. First, the telecommunications systems should be introduced in such a way that the health professionals are made aware of the advantages brought to them by the new technology. The expanded ability for consultation should be regarded as a tool which allows the professional to be more effective, rather than an admission of lack of knowledge on his or her part.

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Second, the health professionals using a telemedicine system should be involved in decision-making from the beginning. Innovative systems must be flexible to allow users to develop their own approaches and new uses of the system.

Third, health professionals should be trained in terms of the technology, so that they are comfortable with it. The health profession is oriented toward the personal; however, many new developments in medical science aside from telemedicine make knowledge of technologies an essential task for the medical professional. Continuing education for present health professionals should address the subject of medical technology.

Possibly the most significant changes that would occur in the health field with telecommunications service delivery and the ones that might constitute the most difficult constraints are the changes in the roles and behavior patterns of the physician, the expanded use of the non-physician, and the attitudes and behavior of the client. As stated before, non-physician accreditation will be a problem, particularly since with telecommunications the non-physician will not be under the direct physical supervision of the physician. Furthermore, the non-physician will have increased responsibility, and unless he or she has been trained sufficiently, not only in the use of the hardware, but in the "protocols" that the increased responsibility requires, there will be difficulties. The client must also be educated or informed of the change in roles he or she will encounter. Where direct contact with the physician may have been infrequent, it also may have served to make the client more confident in the quality of service provided. This confidence must be maintained or re-established through an educational campaign to explain the advantages of telemedicine to the client population.

The issue of payment structure has particular significance in the field of health care delivery, because third party payments are widespread. Payment structures are currently under study because of the new issues which emerge with respect to telecommunications. Reimbursement of non-physician care is the major issue; Medicaid does not at present provide reimbursement for non-physician services, however, as non-physicians play an increasingly greater role in health care delivery, it is widely suggested that reimbursement should take place on the basis of task-performed rather than on personnel level. The payment structure may be shaped to encourage or discourage medical care by non-physicians. Similarly, it may be structured to encourage centralization or de-centralization of health care delivery. A current project linking the Wagner Pediatric Clinic in East Harlem, New York, to the Mt. Sinai Medical Center, also in East Harlem, illustrates this situation. The Medicaid payment for a patient visit to Wagner Clinic is $30, while a visit to Mt. Sinai is reimbursed at $50. Clearly, the payment structure may be used to provide financial incentives for health care providers to organize centralized or de-centralized services and physician care or care by non-physicians with physician supervision. Shaping these structures toward de-centralized services and toward the use of non-physicians in selected types of health care will increase the economic feasibility of telemedicine systems. In addition, a telemedicine system involving various institutions and various levels of medical personnel must solve problems such as how reimbursement should be distributed between physicians and non-physicians and what portion of direct or third party payment should go to the centralized insitution and what portion should go to the outlying medical facility.

In the area of organizational constraints, the frequent lack of coordination between hospitals, medical centers and health education institutions constitutes a major constraint. In order to increase resource-sharing, channels of communications must be developed between the institutions, on a person-to-person and group-to-group level. A rationale for sharing a hardware system must be developed to solve the question of who has access to the system for what amount of time. More importantly, however, the participating institutions must determine needs which can be fulfilled through a resource-sharing network. One example of an opportunity for resource-sharing between institutions is the commonality of needs between various non-physician training programs, while there may be significant differences between nurses and Medexes, for example, there also are undoubtedly many areas of overlaps in their training, in which materials developed for one program may be transferable to the other program. Similarly, materials developed for medical students may also be used for continuing education for physicians. A close analysis of needs and resources of a group of medical institutions will reveal other fruitful areas for resource-sharing.

Since different institutions have different levels of accountability or different populations to which they are accountable, some conflict of goals may arise as the activities of institutions are coordinated. Traditionally, the hospitals and major medical centers have viewed their responsibility as toward whoever walks in the door. The idea of responsibility for the health of the community as a whole is one which has received increasing attention in the past few years, as is shown by the emergence of the neighborhood health clinic, which is geared toward community outreach. Greater penetration in a community, which we can view as an overall social good, carries with it certain impacts on the health care institutions which may not increase efficiency of those institutions. Largely, it is the introduction of needy groups into the health care systems which may present economic problems. If a national health insurance program is adopted, it may solve these problems.

Fiscal constraints on telemedicine systems will require the planning of telemedicine system to utilize various funding mechanisms. Institutions must compare costs of conventional service delivery to telecommunications. The cost-benefit methodology presented in Chapter 9.0 of this report will provide a basis for cost-benefit planning. An actual cost-benefit analysis of telemedicine systems will require data from a specific site.

Similarly, the types of institutional constraints discussed in this chapter must be analyzed in a specific community before implementing a demonstration by both the demonstration planner and the participating institutions.

7.3 Institutional Constraints in Education Services

Institutional concerns in education fall into four general areas: the relationships of the service providers, curriculum development and curriculum control, accreditation, and fiscal and budgetary concerns. The relationship of service providers must be considered at two levels. First to be considered are the realtionships between the institutions themselves. How will libraries link with school systems, and how will these school systems link with more community-based, non-classroom education service delivery institutions? At the level of the individual, the problem becomes more acute. Changes in the educational process are likely to encounter substantial opposition within the academic community. Teachers, administrators, and others involved in the delivery of education are often reluctant to change their teaching styles and administrative methods to the extent required for telecommunications technology to be utilized to its fullest. The concerns of the teaching community over the necessity for personal contact in instruction and the necessity of guarding against "Big Brother" arrangements must be addressed and answered. As in the case of the health professional, the teacher must be involved in design and implementation of educational telecommunications demonstrations: first, so that planners gain the benefits of the teacher's knowledge and expertise, and second, so that the teachers will become advocates of the system. Other actors enter the picture as well once the telecommunications systems are used. Telecommunications technicians, the providers of outside financial resources, local cable operators (where cable systems are used for educational purposes), and the community as a whole each have a part to play in determining the direction of subsequent demonstrations in education. Each brings with it some form of vested interest. These interests are not always in opposition to each other, but rather each of these constituents may view his or her role from a different vantage point.

A successful demonstration will involve identifying the vested interests of the various groups and planning so as to promote those interests.

In curriculum development (or educational programming), the major question is: "Who will choose the content of what will be taught via telecommunications service delivery?" The background of this question is not new, for school system decentralization and control has as its impetus the issue of what, in fact, will be taught to the children. The introduction of telecommunications only makes this question that much more pressing and widens to a considerable extent the arena of debate. Telecommunications opens the doors of education to a far broader audience within a community, and the type of curriculum needed, how that curriculum is developed, and who should develop it, becomes critical.

The issue of accreditation is important because of the current reluctance in some quarters to grant degrees or course credit to community-based educational programs in general. Telecommunications should help to alleviate this reluctance in that it would place the accrediting or degree granting institution in closer contact with the outside programs and, therefore, hopefully provide more information to make judgments with regard to quality of instruction. The other side of the coin, however, is the community argument that these institutions are not the appropriate institutions to determine instructional quality at the community level in the first place, and spokesmen for several communities would argue against telecommunications systems that provided links with such institutions. What they would opt for would be telecommunications systems that allowed community-based educational institutions to penetrate their own community more thoroughly and thereby provide educational skills to larger numbers of the population.

Fiscal and budgetary concerns will be similar to a large extent for all institutions that are involved in telecommunications demonstrations. For educational institutions, the question becomes who pays for the education, on what basis, and how much? Again, in terms of programming, the problem of copyright arises for video or audio taped educational material. Furthermore, in the production of such programming, economies of scale are to be considered. What programming is produced best on a national level (e.g., Sesame Street), and what programming is most effective at the state, local and community levels? The important adjunct is what are the cost considerations? Some of these costs will be examined later in this report, but for specific communities, programming needs and the need for local origination of educational programming will have to be weighed against the estimated costs of developing such programming. Finally, how are costs of a telecommunications delivery system to be shared?

Various institutions with educational functions must first be identified, including not only public school systems and private schools, but also libraries, social service programs with mandates to educate and rehabilitate special populations, and vocational and technical training institutions. Costs are shared between these institutions and, in some cases, by the student. Analysis of the areas of overlap in the goals of these groups will provide a basis for determining areas where costs may be shared.

7.4 Institutional Constraints in Integrated Social Service Delivery.

The integration of social services, including health and education services, suggested in this report involves a number of constraints associated with coordinating and integrating the efforts of institutions which have not been related in the past. The types of constraints to be dealt with may be categorized as administrative, organizational, legislative, personnel-related, and constraints relating to the innovative nature of integrated service delivery systems.

Administrative constraints are well-documented; the lack of conformity in administrative rulings and procedures constitutes a major constraint, as does the lack of flexibility in adapting nationwide and statewide requirements which would facilitate integration of services at the delivery level. Programs which are organized in terms of service categories carry with them regulations individually devised to meet legislative requirements and singularly interpreted in light of a particular agency's objectives. Agencies with dissimilar priorities must reconcile their differing goals in order to collaborate in service delivery. Simplification of applications procedures will encourage such collaborations. Encouragement of joint funding arrangements will also facilitate integrated service systems.

Organizational constraints are based upon the tendency of each organization to view its concerns vertically and does not routinely extend its concerns horizontally to other agencies with similar or related mandates. A vertical view perpetrated at all levels of the agency assures the continued development of programs on a unilateral basis. As long as organizational accountability is conducted in categorical terms, rewards in overall efficiency through integrated service delivery will not receive the credit given to efficiency in categorical programs. Therefore, a change in accountability mechanism is needed to promote integrated service delivery.

The categorical nature of current service delivery methods is dictated legislatively, and these categories, by definition, narrow the services perspective for individual programs. Legislation, for example, has prohibited the co-mingling of funds, the flexible use of resources in a multi-disciplined program effort, and the ordering of service priorities at a local level. A shift is needed toward programs attempting to meet a range of client needs rather than programs which treat needs and problems as if they are distinct and separable.

Restraints imposed by the nature of the medical and teaching communities have already been addressed, with the suggestion that the service providers will become advocates of the telecommuniations systems according to the extent to which they are involved in decision-making and allowed to use their individual creativity to adapt and find new uses for the system. For other social service providers, years of rewards based upon the protection of categorical interests and the defense of individual programs have caused agency personnel at the federal, state, and local levels to view their efforts largely in terms of agency goals and not in terms of effective delivery of services to people. Not to be unnecessarily harsh on these service providers, it is anticipated that many professionals will welcome the benefits associated with integrated service delivery through telecommunications after they are introduced to these systems. Forces whose traditional interests are directly affected by any changes in the status quo include Congressional committees within whose jurisdiction the individual service programs fall and the agencies themselves.

As in any endeavor, the level of knowledge on integrated service delivery systems using telecommunications is low. Only experience will teach the best means of designing these programs.

A final concern in introducing these service delivery systems is the increasing accessibility of services will result in a lack of resources to fill all the service needs. If, for example, the community becomes more aware of available public assistance services, it can be assumed that more people will take advantage of these services and the welfare rolls will become longer. The problem of "too much success" is not, however, in the purview of the current study and will probably be dealt with most effectively if it should arise at a later date.

7.5 A Model of Institutional Service Delivery

While all of the constraints discussed in the previous sections raise crucial problems, they also suggest the potential for institutional change and the synergism that an integrated telecommunications service delivery package might generate. The next section suggests a model of institutional service delivery that delineates the relationships of the various institutions to the clients and to each other in the traditional mode and as a result of the establishment of a telecommunications-based delivery system. This section also discusses the prospects of utilizing existing institutional networks and linkages and the creation of new ones to attempt to alleviate some of the institutional constraints.

Figure 7.1 presents a highly simplified representation of service delivery as a process of flow, interaction and the exchange of information among institutions. A basic precept in this model is that, regardless of the limits on the amount of

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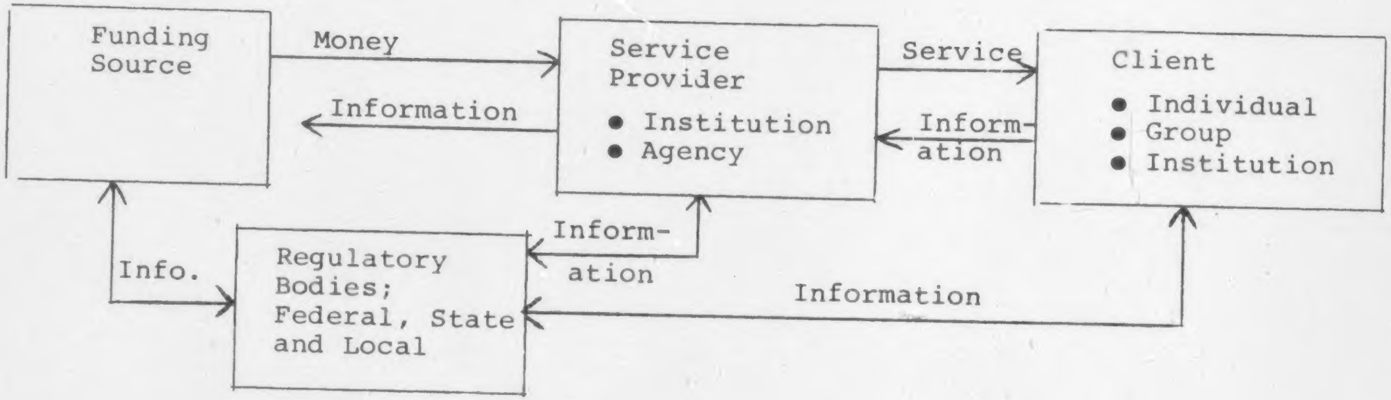
FIGURE 7.1

SIMPLIFIED MODEL OF INSTITUTIONAL SERVICE DELIVERY


Funding Source
Money
Information
Service Provider
● Institution
● Agency
Service
Inform-ation
Client
● Individual
● Group
● Institution
Info.
Regulatory Bodies; Federal, State and Local
Inform-ation
Information

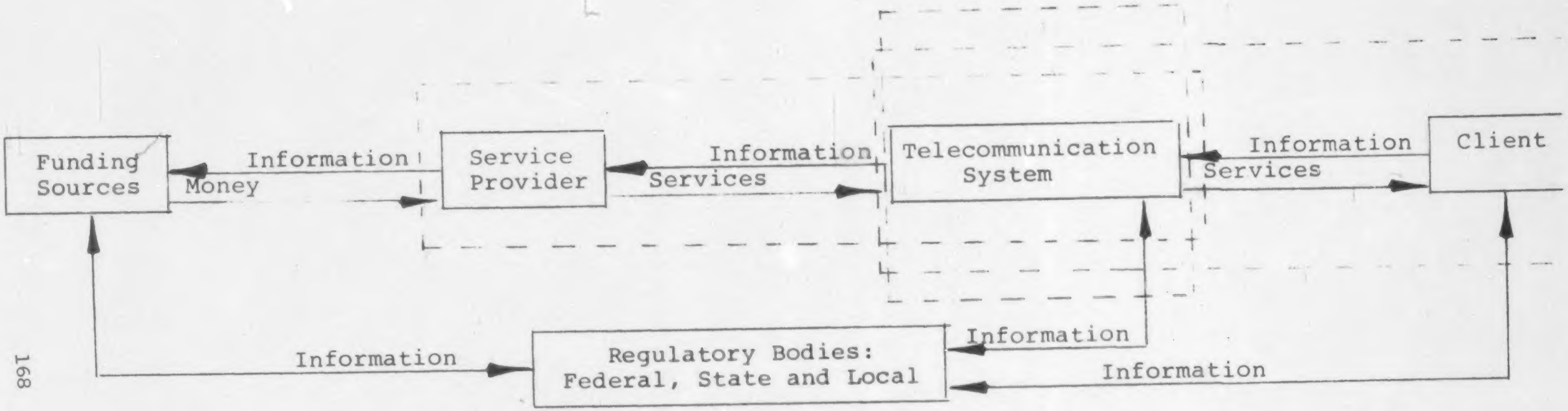
information provided, the client must always provide the service institution with some level of data in order to receive the service. A request for emergency medical service or for assistance from the fire department, for example, requires the client to give at a minimum, his or her name and address. Obviously that sort of information is simple and relatively inocuous. However, as the requested service becomes more detailed and personal, the amount of information exchanged increases accordingly. One can see that this service delivery model has serious implications for individual client privacy. However, there are other implications when the client is another institution or agency. Organizations naturally tend to be very watchful with regard to possible infringements on their "territory" of knowledge, activity and control.

If a telecommunication system is now introduced into the simplified service delivery model, a more complicated flow of information and services is produced. Figure 6.2 shows a model of this new situation. One source of the complexity in this model is the role of regulatory bodies in controlling the uses, the fees, the scope of operation and the technical standards associated with telecommunication systems. The span of interaction between these regulatory groups and the components of the delivery system is greatly enlarged.

Another complicating factor is ownership of the system. The dotted lines in Figure 7.1 are meant to indicate that various mechanisms for ownership are feasible, depending on the nature of the service provided, where it is provided, and the type of

FIGURE 7.2

SIMPLIFIED MODEL OF INSTITUTIONAL SERVICE DELIVERY VIA TELECOMMUNICATIONS


Funding Sources
Information
Money
Service Provider
Information
Services
Telecommunication System
Information
Services
Client
Information
Regulatory Bodies: Federal, State and Local
Information
Information

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telecommunication system utilized. For example, telephone-provided services involve third party ownership of the telephone lines, and the terminal equipment connected to these lines. Terminal owners could be the telephone company, the client, the service provider, or a fourth party. Computer-aided instruction is frequently found within existing educational facilities. Aside from the possible telephone lines connecting the terminal with the computer, the educational institution will own the system. If a broadband two-way cable system were used instead of telephone lines, an entirely different third party might likely be brought into the system, unless, of course, there were a special intra-institutional hook-up.

Yet another complicating factor raised by using telecommunications in social service delivery is the increased isolation between client and service provider. Certain services would no longer request direct interpersonal contact, or "co-presence." Rather, one introduces tele-presence, which has a norm of behavior quite different from the norm established for co-presence. For example, telephone conversations are often quite different from co-presence conversations. While modern man has learned to adapt to these different situations, one must wonder what adaptation will be required when the interaction is even more complicated by the electronics and the complexity of the telecommunications system. In some instances the user and the service provider may both refuse to adapt to such new arrangements, and reject the system completely.

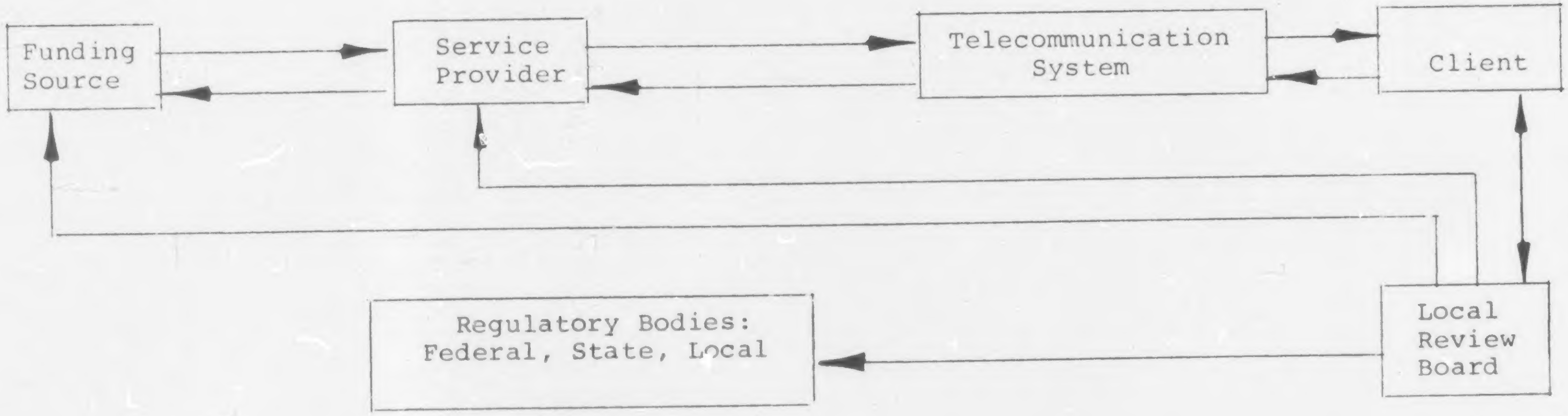
The substitution of this tele-presence for co-presence has impact not only on privacy, but also on initative and responsiveness of the service provider to the wishes of the user. This impact must be carefully assessed in the design of future experiments. One writer has described broadband cable systems as new "electronic highways" linking together separated people and groups. In fact, there is a major concern that these "highways" not be one-way streets trapping the client and that they not serve to further isolate those populations or groups already described as being "socially isolated."

In several instances where telecommunications demonstrations may be conducted, existing social service delivery networks and linkages will be used. The reason for expecting this is that existing structures will probably have the resources needed to carry out the experiments. Further, they will have an established image with the local political, social and economic institutions and this image will help create local acceptance of the experiment. However, there are several problems and concerns created by such situations. One problem is that from the viewpoint of minority populations that might be selected as target populations for the experiments, some of these existing networks and linkages have not previously served their needs, or worse yet, have been detrimental to the well-being of these minorities. In fact, these concerns can affect not only minority populations, but other groups and institutions as well. In such circumstances the introduction of a telecommunication system into the structure may worsen its performance and doom the experiment to failure with respect to user acceptance. In archaic or poorly functioning organizations, the telecommunications system might not bring about the desired impact on costs and benefits, but rather freeze the system into a mode of behavior already deemed unsatisfactory. The point of this concern is that telecommunications technology by itself is a neutral commodity. How it is utilized determines whether the network is leveraged to produce favorable or unfavorable changes in performance, responsiveness, social well-being and cost.

Therefore, the demonstration designs for specific sites should incorporate various checks, balances and safeguards to avoid these problems. These safeguards can be in various forms: legal; technical; financial; and through local review. The service client should be fully informed on the implications of using the tele-service in terms of privacy, responsiveness and other matters. Given the nature of the experiments, the strongest recommendation that can be made is for local review boards to be established with representatives on these boards from the local user populations and service agencies. These review boards should have some degree of control or at least influence on the scope and course of the experiment. Thus, the model presented in Figure 7.2 should be modified to indicate local involvement. (Figure 7.3).

While the dominant mode of operation of the demonstrations will likely be within existing institutional networks, the channeling of demonstration funds through non-traditional organizations, coupled with the introduction of telecommuni-

FIGURE 7.3


Funding Source
Service Provider
Telecommunication System
Client
Local Review Board
Regulatory Bodies: Federal, State, Local

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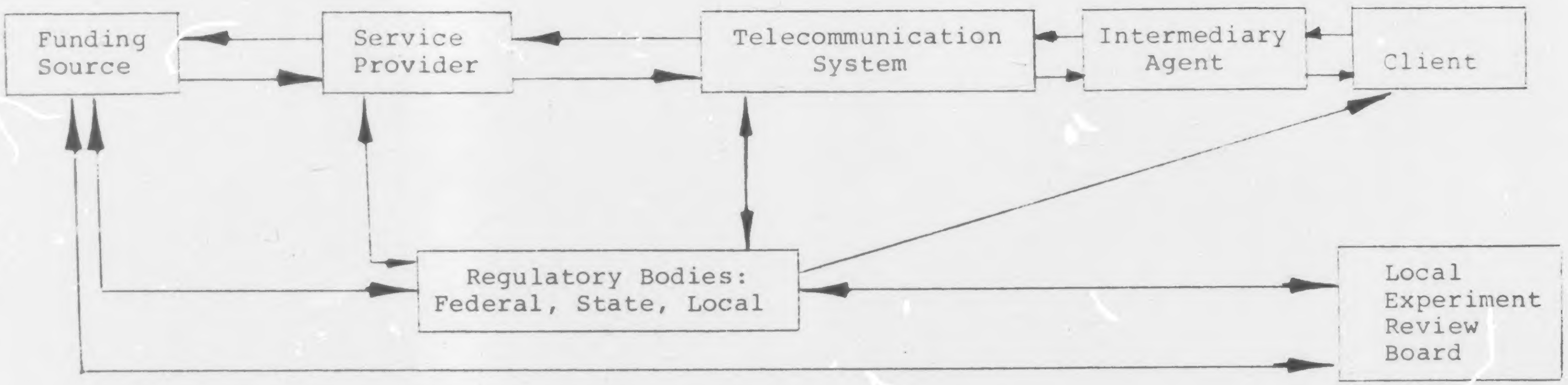
cations can produce new networks and linkages for service delivery. In one sense the aforementioned local review board provides a new linkage between the ultimate user, the funding source, and the service provider. Such a panel overseeing the experiment from a watchdog standpoint, would act as a parallel link between client and provider to overcome any electronic isolation. One can go a step further and consider using such a local panel to control the purse strings for the experimental funds. This would increase the leverage on the social service delivery mechanism in favor of the clients.

Still another institutional linkage that must be considered is the introduction of an intermediary person or agency between the client and the telecommunication system (Figure 7.4). Such a person would, in fact, be an extension of the service provider. This person may be absolutely necessary in those social services where the client would not know how to operate the telecommunications system. A neighborhood clinic, staffed by paraprofessionals, is one example of such an intermediary agency, when the visiting patients have to have telediagnosis performed by a doctor in a distant medical center. Here the paraprofessional operates all the telecommunication terminal equipment and performs certain tests on the patient or administers medication as directed by the physician.

The variations of the model of a telecommunications service delivery system that have been discussed suggest that there are possibilities for client, regulatory, and institutional

FIGURE 7.4


Funding Source
Service Provider
Telecommunication System
Intermediary Agent
Client
Regulatory Bodies: Federal, State, Local
Local Experiment Review Board

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involvement in the removal of many of the institutional constraints presently envisioned. Thus, in many instances, the feasibility of the telecommunications applications may rest solely on the comparative costs and benefits of the telecommunications delivery system vs. the traditional delivery system.

8.0 DEMONSTRATION IMPLEMENTATION

A major barrier to effective planning studies is the lack of appropriate or site-specific information from which to develop workable programs. This report has been hampered throughout by the lack of specific-sites and the need to design service packages so broad as to be applicable under a variety of situations, the universe of which has never been circumscribed.

Furthermore, the time and effort required to perform a cost/benefit analysis of a number of rather different telecommunications systems, each containing a mix of services is an undertaking rivaling a demonstration itself. Therefore, the following items are suggested as essential to any meaningful follow-on study of telecommunications for social service delivery which aims toward the possibility of a demonstration, in approximately the order given:

- A clear definition of the target area (including geographic size, demographics, existing telecommunications systems, etc.);
- A clearly defined service need assessment for the area (compiled primarily by social service delivery personnel, not technical personnel);
- Selection of the service package(s) appropriate to fill the specified needs;
- A detailed engineering specification of the telecommunications system(s) required to implement the service package(s);

- A detailed cost/benefit analysis of demonstration impact.

It is assumed further that the definition of the target area at the top of the above list is sufficiently precise to include in the following steps participation of the actual individuals who will be responsible for the use and success of the demonstration. More than likely this will require specific site selection prior to the subsequent steps. We suggest here that to perform a cost/benefit analysis for an arbitrarily large number of possible services and combinations of services without a site is impractical, for it requires that the exact services and service delivery levels be ascertained prior to such analysis. It is unlikely that this could be done with any real reliability or significance unless it is done with the assistance and concurrence of those responsible for the demonstration to follow, and utilizes data specific to that demonstration site. However, it is possible at this stage to discuss some aspects of package selection and modification for sites generally and to examine some of the considerations that would make a package a proper choice for demonstration in a given site. In addition, the cost/benefit methodology would not alter from site to site or from package to package. It is therefore also possible to suggest what this methodology might be and how the results are to be interpreted. This chapter, then, examines these possibilities and implicitly suggests where the next stages of this study would lead should it continue.

8.1 Site Considerations

The particular service packages, target populations, and geographic locations chosen for the future telecommunications demonstration projects will in many ways determine the success of the projects and the likelihood that they will catalyze further change. It is therefore critical that a means be developed through which wise demonstration choices can be made. The initial phase of the decision process would examine more detailed data on each of the potential packages, and choose among them based upon the preferences of the policymaker as well as upon a more detailed relative evaluation of the packages themselves against specific site criteria.

The criteria are listed and discussed briefly below. They fall into four categories: (1) service needs and technology effectiveness; (2) efficiency; (3) social, political, and legal constraints; and (4) potential for measurement and evaluation.

8.1.1 Service Needs and Technology Effectiveness

Perhaps the most important and most difficult criterion to apply to the choice of service packages for demonstration is the criterion that the service be one for which a significant need exists. It is impossible to determine in any objective manner which services are "most needed." Part of the difficulty has to do with the multiplicity of social groups with varying sets of needs. It must be a social and political decision as to which groups with which particular needs should be given priority for a demonstration project.

8.1.2 Efficiency

The criteria that the packages of services selected for the future demonstrations be economically efficient is conceptually clear, but difficult to apply, given difficulties in estimating costs and benefits of potential projects. With respect to services which have already been delivered, and for which the introduction of telecommunications technology will not substantially increase the benefits to be derived from the service, the criteria of efficiency takes on special importance. In particular, the question is not so much whether a new service can be provided to meet an unmet need as whether the existing service can be provided more efficiently in that site.

Furthermore, the existence of services with a track record to examine facilitates the evaluation of cost-effectiveness, by providing a benchmark of efficiency against which to compare the use of telecommunications technology.

For services which already exist in the area, the question is whether the new technology will be more cost-effective. Assuming benefits to be the same, costs can be compared with each other.

For services which will be provided for the first time through telecommunications technology, the question must be examined in a slightly different context. Having no benchmark of existing performance, the question must be whether the projected benefits exceed the projected costs for a potential project.

8.1.3 Constraints

Social, political, and legal constraints provide a rich field for consideration, as various groups within a site will have diverse attitudes toward what comprise relevant social and political constraints. Legal constraints will be more clear-cut; however, it may be expected that some changes will ensure due to the impact of telecommunications in this field.

Social and political constraints will deal with issues such as the attitude of the service recipients to the delivery system. If the service recipients have come to view telecommunications-based service projects as "second class service," this attitude constitutes a constraint. In addition, a political constraint is operative in situations in which service providers actually do provide an inferior type of service through telecommunications to certain populations, with the attitude that it is superior to no service at all. The problem of attempting to provide services to groups which are low-priority for service delivery (as illustrated by the fact that they are currently underserved) will have several political facets which must be considered.

Human rights issues will be of central important in analysis of various service possibilities. Policy decisions must be made to protect the service recipients from possible abuse of privacy from these technologies. Particularly in the case of the target populations designated in this study, the possible dangers must be anticipated, and safeguards in each demonstration must be built int. (In fact, services which have great possibility for invasion of privacy have been eliminated purely on that basis.) The target populations in most of the sites will be composed of various powerless groups in the society who, by definition, have not in the past found the institutions in the society to be responsive to their needs, and it is reasonable to assume that violations of rights may occur against which the group will have no recourse. In cases in which the value of the service provided seems to balance fairly evenly with the possibility for abuse, the correct procedure may be to go to the specific community and allow it to decide for itself, weighing the pros and cons. In some cases, the community members may not be able to anticipate problems associated with new systems of service delivery, and it will be the responsibility of the service providers to apprise them of the facts. Reports from those in the field suggest, however, that there is rising consciousness of possible abuses of telecommunications technology among citizens. Surveillance equipment is suspect, as are management information systems which make possible centralized record-keeping on individuals. In some communities, organizations have emerged for the purpose of restricting computerized record-keeping and monitoring how organizations such as credit companies use personal information. For some services, education of community members may serve to lessen or erase community resistance to the service. In others, the attitude of the community must be the prevailing rule.

Even with a "target population" specified, there is no single means to prioritize their service needs. However, the need criterion remains important to insure that limited resources for demonstration projects are not devoted to low-priority service needs.

One solution to this difficulty lies in considering the contribution of telecommunications technology to the delivery of the services at the site in question and the effectiveness of this technology for the particular purpose. This immediately rules out sites for which the introduction of telecommunications technology would appear to have little value; that is, areas in which certain services can be delivered without this technology as well as with it. Thus, some potential packages can be eliminated for a given site by considering the effects of the technology on the individual services in the packages for that specific site.

A second solution might be consideration of the limitations or inadequacies of existing service delivery programs. That is, needs which are already being met adequately in a specific site can be given a lower priority than those which are not being met at all. The task of prioritizing the service packages according to needs can be completed through the exercise of informed judgement by policy-makers, drawing on their own preferences and the expressed preferences of administrators and users related to existing service programs.

8.1.4 Measurability and Impact Evaluation

Measurability of services is necessary in a demonstration project in order to determine whether the project should be implemented on a larger scale. Packages should not be judged purely on the basis of whether they save money for the service providers, for attitudinal acceptance by the service providers and service recipients is equally important. On a practical basis, innovative systems will not be efficient unless they are advocated by the people who work with them. Success of projects may also be judged by the number of individuals who gain social services and the benefit to the service recipient of the system. It is also important that the demonstration not be directed toward a target group or service need that is so specific that the results are not applicable to other situations.

Evaluation of the impact of innovative service delivery systems in specific demonstrations has two major functions; to determine the feasibility of the telecommunications-based service delivery system, and to change the goals and operations of the system to increase positive results.

The evaluation process for a demonstration should be designed and conducted by the people who can best use the results to improve the system. These people are the funding agencies, both Federal, local, and private; the service providers, on the managerial and staff level; and the service recipients, either as a whole or as represented by a community advisory board (as suggested in Section 6.5).

In addition, self-evaluations should be conducted, in which the various actors evaluate success of the service delivery system in terms of their own role within it. Cost evaluation can be made, judging the cost-effectiveness of using the telecommunications technology rather than conventional service delivery mechanisms.

Attainment of overall program goals and of interim operational program goals will be a primary measure of success of the demonstration. Success of program goals are quantifiable by measures of the number of people receiving services, number and kind of services delivered, number and kind of services delivered indirectly by referral to other services, the trend toward preventive rather than treatment services, and major changes observed in the problem areas being addressed, target populations being served, behavior of institutions toward the needy target population, and the resources available to the target population. Some examples which illustrate how these factors might be judged include, for example, reduced infant mortality, reduced school dropout rate or a rise in the community educational level, reduced unemployment, and reduced social isolation. Observable changes in the service environment might include an increase in quality and quantity of staff available to the target population, improvements in facilities and addition of facilities serving the target populations, and quality, quantity, and comprehensiveness of services offered.

It is of major importance that these demonstrations be evaluated on a multi-level basis, rather than simply on the basis of the satisfaction of the service provision establishment. Cost-effectiveness, for example, should be judged not only on the basis of cost savings for the service providers, but also on the basis of cost savings of time and money for the service recipients. The object of innovation in service delivery methods is to go beyond the scope of current practice, and to serve new target populations, and to provide new services in general. Therefore, the programs obviously cannot be judged purely as conventional programs have been judged, but must be judged in terms of these goals.

A major lesson that has been learned by experiments in this field in the recent past is the error of attempting to judge the success of the service delivery systems too quickly. One-year and two-year projects only begin to smooth out operational problems, and the real results of improved service delivery will be revealed by more long-range comparisons of the well-being of previously needy target groups. It is not necessary to wait generations to evaluate the effectiveness of service delivery programs; however, it is important to remember that a truly innovative service delivery program will upset the present patterns of service delivery in establishing new and more effective patterns. A period of transition must occur, in which adjustment of technology and adjustment of people to technology can take place.

To the extent to which the roles of service providers and service recipients are affected by the new mode of service delivery, one may expect that disruption will occur until the adjustment is successfully made. Resistance to change exists both because of vested interests in current operation and simply out of fear of change. Neither of these factors constitutes a serious obstacle to change; however, this resistance should be understood and dealt with properly. Education of the people involved is necessary, as well as flexibility of systems so that the ideas of teh people involved may be incorporated when appropriate, thus facilitating adjustment to the change. In this way, evaluation of the system by the users becomes part of the process of refinement and improvement of the delivery mechanism.

8.2. Cost/Benefit Methodology

In this section, we shall present a cost/benefit methodology, which represents one of the more critical components in the ultimate selection of demonstration service packages. Why this methodology is applicable in the ultimate selection, but not in the present non-site-specific environment might become clearer if we consider the cost/benefit factors in an exemplary service.

Suppose we select a telecommunications-deliverable service such as telemedicine, in which we can postulate no change in demand for medical services will occur. Hence, we can ignore the usual market analysis required in a cost/benefit analysis. The only effect of telecommunications we have to consider is whether and by how much, the introduction of telemedicine and the substitution of nurse practitioners for physicians reduce the cost of delivering equal-quality medical care. In order to determine this, we must know the time it takes for a nurse practitioner to treat a patient; the time requirement for nurse practitioner-physician consultation (if needed); the probability that such a consultation is required, the time requirement for a subsequent patient-physician consultation if complications arise; the probability that this consultation occurs; the patient load of the medical practice (patients per hour); and in emergency-based practices, the variance of the patient load; the salary of a physician, the salary of a nurse, practitioner, and the number of physicians, practitioners, and nurses. (The ratio of this last item, nurse practitioner per physician, is itself endogenous to the optimization process and should be determined according to the values taken by the other factors.) Note that virtually all these parameters will vary significantly according to site. For example, telemedicine, will probably be relatively cost-effective in practices with large patient loads, in labor-intensive practices, in types of practices with physician-nurse practitioner substitutably, and in parts of the country where the ratio of physician salary to nurse practitioner salary is relatively large. Whether telemedicine proves profitable is dependent upon the particular parameter of the site; furthermore, whether telemedicine is relatively more profitable than other potential uses of telecommunications is extremely dependent upon site-specific variables. Clearly, the effort and highly-detailed information needed for a meaningful cost/benefit analysis requires some finite number of service alternatives and, more importantly, site-specific data.

8.2.1 The Concept of Cost/Benefit Analysis

As the name suggests, cost/benefit analysis attempts to measure all relevant costs and benefits, both direct and indirect and private and social, that can be quantified and translated into monetary terms. Direct costs and benefits normally constitute the bulk of the analysis and involves all purchasing (cost) and sales (revenue) transactions connected with a service. Included would be all hardware, leasing or rental rates, the cost of supplemental hardware and all software/programming, overhead expenses, and all additional personnel and training expenses. Indirect costs and benefits, although usually a relatively small component of cost/benefit analysis must also be accurately calculated in order to achieve a meaningful result. Indirect cost and benefit components include benefits foregone or costs eliminated as a result of the service and, thus, involve no direct cash outlays. For example, on-the-job training via telecommunications will normally involve an indirect cost to the employer of work foregon during the hours the employee is in training. (Presumably, this indirect cost is being calculated as the employee's wage rate.)

Private costs and benefits include mainly the components of a firm's or agency's profit and loss. Social costs and benefits, or externalities, involve cost and benefit components of a service that are external to the group under consideration but that do affect some segment of society. Environmental and congestion factors are the most commonly cited forms of externalities. For most government evaluations, both private and social components receive consideration; however, for the purposes of this demonstration, where involvement of the private sector and relative financial self-sufficiency are desired, certain services should be evaluated only in the light of private costs and benefits. The appropriateness of private versus social cost/benefit analysis will receive additional treatment in Section 8.2.3.

In order to consider both the amount of net benefits and their timing, the cost/benefit data should be converted to present value, a technique which discounts over time a factor which reflects the social rate-of-return. Thus, our approach for cost/benefit analysis of the suggested service packages (and options) begins with the discounted costs and benefits of a basic technology and its concomitant services and then estimates what additional discounted costs are imposed and what discounted benefits accrue as supplemental hardware and more services are added on to the system. Comparisons among service packages will then be accomplished by comparisons of internal rates of return, which equate the present value of lifetime benefits attributable to a service to the present value of the costs of that service.

8.2.2 Measurement of Cost/Benefit Components

Insofar as the actual service costs and benefits are quantifiable and can be estimated with a reasonable degree of accuracy, cost/benefit analysis remains as probably the least subjective method for evaluating alternative delivery modes. However, the problem of quantifying and monetizing costs and benefits accurately is far from simple, and, in fact, the measurement component usually constitutes the most difficult and time-consuming aspect of cost/benefit analysis.

Ideally, the cost-benefit analysis should be measured by cost reductions, since cost data is usually the easiest to estimate and the most objective. Comparisons of cost data alone is possible where an alternative delivery system provides a perfect substitute for the conventional service and does not affect the nature or price of the service or the market for that service. The following figure describes the nature of cost savings in this simplest of cases:

DD is the demand curve for the service. CAC represents the average cost curve for the service with conventional delivery. TAC represents the average cost curve with telecommunications delivery. We assume, for simplicity, that the institution providing the service is non-profit in character if not in fact so that it attempts to equate price to cost. So long as the demand curve intersects the average cost curve with conventional service delivery to the right of Q_M, then

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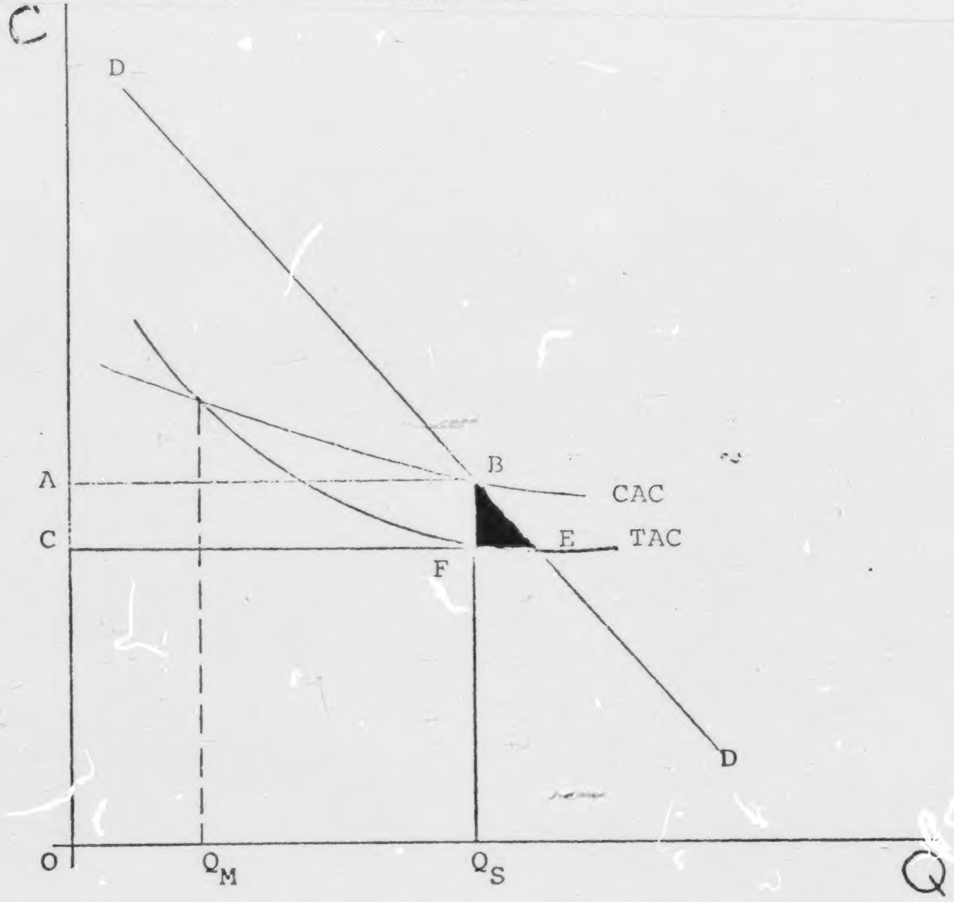
FIGURE 8.1


C
D
A
B
CAC
C
E
TAC
F
D
O
Q_M
Q_S
Q

the institution in question will find it profitable to employ telecommunications delivery. Assuming that the market for the service remains constant at Q_S (i.e., if the price of the service remains unchanged), then the benefits of telecommunications delivery can be represented by ABFC. The statis rate of return in this case would be ABFC divided by CFQ_SO; this rate-of-return is what will be compared with the rate-of-return of other services and other service packages. Note that even if the institution, as a result of its cost savings, reduces the price of the service to OC, total benefits are only underestimated by BFE, the contribution to consumer surplus from new customers. BFE should be insignificant except when demand is highly price elastic. Furthermore, by estimating benefits as ABFC, we avoid the very difficult task of estimating a demand curve for the service.

Unfortunately, in most instances, even when new service delivery completely replaces the conventional service, the change in delivery systems will affect the nature of the service or the price of the service, either of which will invariably affect the market for that service and, hence, the potential benefits. An even more serious problem is the fact that many telecommunications services do not replace conventional services, but either represent an entirely new service or merely supplement existing services. In all of the above cases, comparisons with existing services in order to estimate potential telecommunications benefits are virtually impossible without site-specific market analysis[1].

In the case of a telecommunications demonstration, the solution we suggest is a large on-site survey both of individual and institutional needs and also of these users' market preferences for various services. The latter survey, in particular, should be employed whenever it is anticipated that a non-zero price will be charged for the service. Unfortunately, too often in the past, no market forecast was prepared, or a "needs assessment" was substituted for a market analysis. It should have come as no surprise, in those instances, that demand for the service fell far short of capacity or demonstrated need. The result was that, in many instances, the demand for the service did not justify the technology. Clearly, estimating the demand curve for a relatively unknown service is a complicated task, requiring sophisticated economic and statistical tools. But, a well-devised survey, in which potential users are asked to "purchase" services from among a selective variety of alternatives, should allow the demonstrator to derive relatively accurate demand estimates for most types of services.

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[1] Nor can we avail ourselves by estimating cost savings from telecommunications service delivery as compared with what the service, if it had existed, would have cost with conventional delivery. Since the service did not exist with conventional delivery, conventional costs are irrelevant and clearly overestimate the value placed on the service (since at that cost, no market existed); hence, a comparison with conventional costs will overestimate the savings (benefits) from the new service.

A measurement problem equally as serious as demand curve estimation is that the benefits of many supplemental services that enhance existing services can normally not be quantified or estimated in dollar terms. For example, one benefit of telecommunications delivery of education may be to improve the quality of education, but it is virtually impossible to impute dollar values to such quality improvements. Similarly, the fact that home instruction provides a more comfortable and convenient surrounding to the individual than a classroom or auditorium does not mean that the improvement is quantifiable, particularly if the new service is unpriced. In addition, most types of externalities, related either to new, supplemental, or replacement services, are traditionally difficult to estimate both because the externality (such as congestion costs, etc.) is difficult to quantify and because the range of the externality (how many people are affected by congestion) is unknown, and possibly unknowable. In all of the above cases, the probable solution is to ignore the unmeasurable effect if it can be determined that the influence of the unmeasurable components is relatively minor. Fortunately, in a large number of cases, the unmeasurable component will probably turn out to be insignificant. When the unmeasurable effect is large, the only real solution, even though it reduces the meaning of the analysis, is to make as good a "guesstimate" as possible of the effect and qualify the results accordingly.

A final, although less difficult, measurement problem involves telecommunications delivery of a service whose main benefit is to save the user's time. This will be the case in many municipal or social services that more widely disseminate information or provide the service more quickly. Clearly, what we wish to determine is how the user values his time, but in most instances, this would be a very subjective task. Should the user's time be valued as a free good? By his wage rate? Or somewhere inbetween? The usual estimate of user time is by his wage rate, but would imply that waiting time for the unemployed is zero-priced. Clearly, this is inappropriate, but a better approach is not immediately apparent.

The problem of evaluating and monetizing time is even more complicated in emergency situations where telecommunications service delivery can save precious seconds, which can be translated into property and lives saved. (Telecommunications-aided assistance in the case of fire, burglary, or illness would certainly fall in this category.) Relating time saved to property and lives is difficult enough, but how do we calculate the value of lives saved? Several unsatisfactory approaches have been employed in the past:

(1) The discounted value of the average victim's expected future earnings, which erroneously implies that the death of a retired person confers a benefit on society;

(2) The discounted loss to the economy from the anticipated income generated by personal expenditures for the expected remainder of the victim's lifetime, which erroneously assumes that personal values are dependent upon one's contribution to GHP;

(3) The value of a victim's life insurance policy, which erroneously represents the value a man sets on his life, but instead should be interpreted as only part of a family financial portfolio and a reflection of concern for family and dependents.

The approach we suggest revolves around the concept of "statistical" death as opposed to certain death. How an individual values his life cannot be directly ascertained from the individual, since most persons would be unwilling to accept certain death at any price. But what we are concerned with is what people are willing to pay to reduce the risk of death, statistical death. For example, assume safety device costs X dollars and reduces the risk of death by $\frac{1}{Y}$. Assuming only that a risk-of-death function were linear and that the real risk reduction from, the safety device were known by the individual, then we can estimate the value of a human life to be approximately XY.

8.2.3 Effects of the Demonstration

The fact that our cost/benefit analysis will be performed in order to determine optimal demonstration packages may require modification of our cost/benefit methodology in three distinct ways:

First, insofar as a demonstration, as opposed to long-range service delivery, may involve special payments mechanisms and special actors and actor relationships, it is critical to identify who, in the long run, is expected to pay for the telecommunications system and who is expected to benefit from the telecommunications system. The reason is that, if the parties who pay and the parties who benefit are different, then it is quite possible that the "payees" may, in fact, have no incentive to pay.

For example, a municipality that is interested in providing the present level of services at minimum cost may not find the additional benefit from citizen's time saved to be a persuasive argument in favor of telecommunications delivery unless the new system also reduces the total cost of service. Similarly, the external benefits of reducing congestion by cable deliveyr of university courses will not be considered by the university administrator in deciding whether to employ the cable system.

Second, it is probable that demonstration delivery will not entirely replace conventional service delivery. Many families, not involved in the demonstration, will require conventional service delivery. In these cases, benefits from the new system must be compared with the costs of both the new and the old systems. For example, if facsimile mail service existed for a portion of the mail market and conventional mail service existed for the remainder of the market, the cost of serving the market using the new system must be compared with what it would cost to serve that portion by conventional means. (The total cost of the new system would have to be less than the additional variable cost of serving the new market by conventional delivery.)

A third and final point is that, for this demonstration, the cost-benefit analysis may not be able to estimate benefits over the life of the system or the life of the service, but rather, the analysis may extend only through the life of the demonstration. Thus, as well as providing high returns, the service packages must, during the demonstration life span, demonstrate some level of cost-effectiveness.

9.0 POLICY ISSUES

Several policy issues are important to consider at this juncture in terms of developing telecommunications demonstrations. Of prime importance is the issue of privacy that has so frequently been referred to in this report. A related issue is that of community control. A third policy issue is regulatory behavior, and a final major policy consideration is payment for services. Each of these is important in that governmental behavior on the legislative, judicial, or regulatory front will have grave impact on the scope and nature of service delivery via telecommunications.

9.1 Privacy

Throughout this study, concern has been expressed with regard to the potential for loss of privacy and violation of civil liberties implicit in many telecommunications applications. Particularly in areas where centralized personal files are suggested to facilitate service delivery, the potential for unauthorized access to records in large. Furthermore, the increased utilization of two-way CATV in the home (should it be facilitated by one of the demonstrations) provides another communications link that is capable of being intercepted or "eavesdropped" on for improper purposes.

Certain obvious precautions must be taken in the compiling of computerized information on individuals. Access to the information must be strictly controlled -- although it seems unlikely that any municipality will deny access to individual records by a Federal government that seeks it in the name of "national security." It has also been suggested that individuals should have access to their own computerized personal data and should have a right to challenge the contents. Formidable problems nevertheless remain to be dealt with through legislation and through civic vigilance as the technology comes into increasing use.

In terms of two-way CATV message interception, the answer probably lies in more stringent laws against invasion of privacy in general, with specific reference to the new problems brought about by cable technology. In addition, scrambling devices and other technological safeguards can be required as part of systems in which the possibility of such misuse is a strong possibility.

9.2 Community Control

An additional safeguard against invasion of privacy is that the control of the system be in the hands of the user -- i.e., community control. Community control is not a new issue, but both the potential usefulness of telecommunications technology in providing new and improved services to the community and the potential dangers inherent in the encroachment of such technology upon the unaware make the issue of system control a very sensitive one. Local communities, particularly minority communities, had have little access to the media; and cable and other new telecommunications technologies might serve as a vehicle through which the views of these communities are expressed. However, for this to occur, adequate access must be made available. The only sure way that such access will be available is for the communities to exercise a strong voice in the governance of the communications systems in their areas. Whether this will occur or not in the near future is a question of serious debate. The local policy review board suggested in Chapter 6.0 may be the type of group that could leverage adequate community power to achieve some degree of influence in the determination of policy.

9.3 Federal Regulatory Policy

Federal regulatory policy toward telecommunications has only marginally focused upon social service delivery via telecommunications. Instead, the overriding bulk of regulatory policy has been devoted to the competitive struggle between over-the-air television and CATV for the rights to the television entertainment medium (educational and local origination program requirements not withstanding). In a real sense, however, the struggle of CATV, and the regulatory posture which has limited its present penetration, have crucial implications for the development of telecommunications-based social-service deivery system. For the most part, any large-scale scheme of telecommunications social service delivery is dependent upon a pervasive cable mandate with a concomitant large-scale penetration rate. So long as FCC regulatory policy effectively prohibits cable from entering primary U.S. markets and consequently limits total cable penetration to under 15% the entertainment-established base of potential telecommunications-delivered social service users will remain too small to justify the formidable hardware expense of wiring a community. Unless Federal cable policy becomes more supportive of CATV and less protective of commercial over-the-air interests, we predict that social service delivery via telecommunications will be constrained to demonstrations at a few CATV sites and to limited point-to-point institutional linkages.

The previous conclusions, however, are not necessarily critical of present (relatively restrictive) regulatory policies regarding CATV. Whether the large-scale development of CATV is warranted, either as an entertainment medium or as a social service medium or both, is a highly complex issue well beyond the capabilities of this study to attempt to deal with. More importantly, Federal regulatory policy towards CATV does not inhibit other telecommunications technologies such as videocassette and telephone-based systems. In a sense, regulatory constraints on CATV might be interpreted as residual support for these alternative telecommunications technologies. In any event, regulatory issues will shape, to a large extent, whether telecommunications in general will have wide spread applications in service delivery, and if so, which specific telecommunications technologies will be likely to be utilized for such purposes.

9.4 Payment for Services

Critical in all the future telecommunications experiments is the issue of paying for the services in an on-going, viable manner. The key to payment will be perceived value on the part of the user, and cost-benefit improvements on the part of the service provider. Where broadband, television signals are used to provide the service, one will have to change the attitudes regarding television receivers. For a user in the general population to consider paying for certain services delivered by CATV, that person must view the receiver as more than just an entertainment medium. One might adopt selective or marketing practices to sell certain social services delivery. Such practices would seek to increase the overall market for CATV by adding on select audiences, where the profit is a marginal or increment contribution to the whole.

However, certain social services can only be paid out of general tax funds collected at the federal, state or local level. Under the present circumstances of tight budgets and resistance to increased taxation, payment will amount to a re-allocation of public sector resources. For such reallocation to occur, the service provider must perceive a clear benefit in either costs or benefits, while the user must be willing to accept the changes. Here the role of a local policy review board will be critical. This board must assure that the new services are what the service clients want and can accept. Furthermore, where service users have an opportunity to influence the way public funds are spent on social service delivery, change in the overall system of delivery will be made possible.

Appendix A

Telecommunications Users Advisory Committee

Mr. Rodney Alexander
Mt. Sinai School of Medicine
Section on Communications
New York, New York

Dr. Kenneth Bird
Massachusetts General Hospital
Boston, Massachusetts

Dr. Donald Bitzer
Director of Computer Based Educational Research Laboratory
University of Illinois
Urbana, Illinois

Ms. Dolores Delahanty
Director of Human Services Coordination Project
Louisville, Kentucky

Mr. Carl Husby
Finance Director
City of Sunnyvale
Sunnyvale, California

Dr. Levi Lathan
Director of Curriculum Planning and Media Services
Illinois State Government
Springfield, Illinois

Mr. Daniel Leahy
Vice President
Public Telecommunications Corporation
Boston, Massachusetts

Dr. Fred Lundberg
Director, Information Systems Center
Cincinnati, Ohio

Dr. Helen Matthews
Director, United Board for College Development
Atlanta, Georgia

Mr. David Ochoa
Director of Bi-Lingual Children's
Television Workshop
KNBC
Burbank, California

Mr. Harold Pyke
Operational Director, Interact
Dartmouth Medical School
Hanover, New Hampshire

Mr. Glen Ralston
Department of City Planning
New York, New York

Dr. Arthur Thomas
Director of Bolinga Black Cultural
Resources Center
Wright State University
Dayton, Ohio

Mr. Paul Weber
Director, Lane County Data Processing
Center
Eugene, Oregon

Mr. Chester Yazzie
General Manager, Navajo Report
KOAI-TV
Flagstaff, Arizona

Mr. Thomas Hargadon
Mayor's Office
Boston, Massachusetts

Appendix B: Cost and Hardware Analysis

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TABLE A
SYSTEM CAPABILITIES

SERVICE OR FUNCTION	A		B		C		D		E		F	
	Home Access	Institutional Access	Home Access	Institutional Access	Home Access	Institutional Access	Home Access	Institutional Access	Home Access	Institutional Access	Home Access	Institutional Access
Cablecasting	●				●		●					
Alarm & Meter Monitoring	●											
Polling	●											
CAI (limited interaction)	●				●							
CAI (substantial interaction)				●								●
Commercial Services	●											
Remote Data Retrieval	●					●						●
Remote Computation	●					●						●
Single Frame Video	●			●								●
Automatic Audio Response	●			●	●	●						
Digital Data Return (limited)	●				●			●				
Digital Data Return (substantial)				●		●						●
Dial Access to Computer					●							
Teleprinter Network						●						●
Audio/Visual Conferencing – Consultation								●		●		●

TABLE B

COMPONENT AND SUBSYSTEM COSTS

	CAPITAL COST ($)					OPERATING COST ($/Y		
	Initial Purchase	Spare Parts	Test Equipment	Miscella-neous	Total	Rental	Personnel	Tot
COMPUTER AND HEADEND EQUIPMENT								
Main Processor (NOVA 800, 64K words main memory)	39,000	3,900	1,950	3,900	48,750			
Terminal Processor (NOVA 800, 32K words main memory, 128 ports)	15,000	1,500	750	1,500	18,750			
Moving Head Disc Drive	12,000	1,200	600	1,200	15,000			
Moving Head Disc Control	8,500	850	425	850	10,625			
Fixed Head Disc Drive	5,000	500	250	500	6,250			
Fixed Head Disc Control	3,500	350	175	350	4,375			
Magnetic Tape Drive	6,600	660	330	660	8,250			
Magnetic Tape Control	2,400	240	120	240	3,000			
Computer-to-Computer Link	3,000	300	150	300	3,750			
CRT Console	3,000	300	150	300	3,750			
Line Printer	18,000	1,800	900	1,800	22,500			
Modem (for portable terminal)	2,000	200	100	200	2,500			
Hard Copy Terminal	5,000	500	250	500	6,250			
Portable Terminal	3,000	300	150	300	3,750			
CATV Channel	2,500	250	125	250	3,125			
Polling Channel	2,500	250	125	250	3,125			
Cabinetry & Miscellaneous	11,000			1,100	12,100			
Data Controller (initial--30 line card capacity)	6,000	600	300	600	7,500			
Data Controller (supplemental--30 line card capacity)	2,000	200	100	200	2,500			
Line Card (local--4 line capacity)	400	40	20	40	500			
Line Card (dialup or leased line--2 line capacity)	400	40	20	40	500			
Computer Supplies	10,400			1,040	11,440			
Character Generator	7,000	700	350	700	8,750			
Audio Response Subsystem (20 ports)	56,000	5,600	2,800	5,600	70,000			
Audio Generator	2,500	250	125	250	3,125			
Multiplexer (character generator to refresh)	2,000	200	100	200	2,500			
Multiplexer (polling data)	2,000	200	100	200	2,500			
Modem (polling data)	2,000	200	100	200	2,500			

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TABLE B (page 2)

COMPONENT AND SUBSYSTEM COSTS

	CAPITAL COST ($)					OPERATING COST ($/Yr.)		
	Initial Purchase	Spare Parts	Test Equipment	Miscella-neous	Total	Rental	Personnel	Total
Video Modulator	1,000	100	50	100	1,250		100*	100
Colorizer	1,000	100	50	100	1,250		100*	100
Combiner Network (one req'd per segment of CATV system)	5,000	500	250	500	6,250			
Test and Patch Facilities	2,000	200	100	200	2,500			
Graphics Digitizer	30,000	3,000	1,500	3,000	37,500			
Miscellaneous Audio and Special Equipment	10,000	1,000	500	1,000	12,500			
* Required only if located away from headend								
TERMINAL-RELATED EQUIPMENT								
TV Set--Color (for terminal use)	250	12.50	12.50	25	300		25	25
Luminance Refresh (per port)	650	65	33	65	813			
Color Refresh (per port)	85	8.50	4	8.50	106			
Refresh Control Electronics	9,000	900	450	900	11,250			
TV Modifications (per set)	70	3.50	3.50	7	84		7	7
Video Tape Player	880	88	44	88	1,100		88*	88*
Keyboard--TICCIT	175	9	9	18	211		17.50	17.50
Crossbar Switch	17,000	1,700	850	1,700	21,250			
Digital Switch Matrix	10,000	1,000	500	1,000	12,500			
TV Camera (including microphone)	800	80	40	80	1,000		80*	80*
TV Production Console	6,400	640	320	640	8,000			
Commercial Terminal (4 button with CATV modem)	100	5	5	10	120		10	10
Commercial Terminal (12-20 button with CATV modem)	250	12.50	12.50	25	300		25	25
Commercial Terminal (full alphanumeric keyboard with CATV modem)	300	15	15	30	360		30	30
Commercial Acoustically Coupled Keyboard (12-20 button)	112	6	6	11	135		11	11
Commercial Acoustically Coupled Keyboard (full alphanumeric)	250	12.50	12.50	25	300		25	25
Teleprinter--local (purchase)	800	40	40	80	960		80	80
Teleprinter--local (rental)						450		450

* Required only if located away from headend.

TABLE B (page 3)

COMPONENT AND SUBSYSTEM COSTS

	CAPITAL COST ($)					OPERATING COST ($/Yr.)		
	Initial Purchase	Spare Parts	Test Equipment	Miscellaneous	Total	Rental	Personnel	Total
Teleprinter with Acoustic Coupler (purchase)	1,200	60	60	120	1,440		120	12
Teleprinter with Acoustic Coupler (rental)						630		63
Tone Telephone (12 button)(extra cost over rotary dial type)						24		2
Microphone	70	7	4	7	88		7*	
FM Modulator	500	50	25	50	625		50*	50
Teleprinter Modem (CATV interface)	300	30	15	30	375		30	30
Video Tape Cartridge	46				46			
Terminal Installation	20				20			
Cabling (per terminal)	25	2.50	2.50	5	35			

* Required only if located away from headend

TRANSMISSION CHANNEL-RELATED EQUIPMENT

	Initial Purchase	Spare Parts	Test Equipment	Miscellaneous	Total	Rental	Personnel	Total
Data Access Arrangement (telco rental)						36		36
Leased Telephone Line (local area, for teleprinter)(per mile)						17		17
Leased Telephone Line (local area, for CRT terminal)(per mile)						40		40
Leased 6MHz CATV Channel (per 1000 total CATV subscribers)						3,200		3,200
Leased 6MHz CATV Channel (point-to-point, per mile each way)						120		120
Bidirectional CATV System Upgrading (per 1000 total CATV subscribers)*	70,000	7,000	3,500	7,000	87,500		7,000	7,000
CATV Subscriber Installation (basic service)	10				10			
CATV Subscriber Provision for Privacy	50	2.50	2.50	5	60		5	5
CATV Subscriber Annual Charge (basic service)						120		120
Installed 1-way CATV System, Including Headend (per mile)	10,000	1,000	500	1,000	12,500			
Installed 2-way CATV System, Including Headend (per mile)	15,000	1,500	750	1,500	18,750			

* Approximately one-half the cost if system initially designed for two-way applications

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TABLE B (page 4)

COMPONENT AND SUBSYSTEM COSTS

	CAPITAL COST ($)					OPERATING COST ($/Yr)		
	Initial Purchase	Spare Parts	Test Equipment	Miscellaneous	Total	Rental	Personnel	Total
SYSTEM AND SOFTWARE ITEMS								
Demonstration Operations and Maintenance							450,000	450,000
System Development (staff time)	300,000				300,000			
System Software Development	300,000				300,000			
System Development Supplies	20,000				20,000			
Courseware	700,000				700,000			

TABLE C

SUBSYSTEM AND COMPONENT CHECK LIST

	A	B	C	D	E	F
	TICCIT Demo Two-Way Public Interactive CATV	TICCIT CAI Two-Way Institutional Interactive	Dial Access With One-Way Public CATV	One-Way Public Two-Way Institutional Interactive CATV	Two-Way Institutional CATV	Two-Way Institutional Interactive CATV
COMPUTER AND HEADEND EQUIPMENT						
Main Processor (NOVA 800, 64K words main memory)	1	0.9	0.9	0.9		0.9
Terminal Processor (NOVA 800, 32K words main memory, 128 ports)	1	1	1	1		1
Moving Head Disc Drive	6	3	3	3		3
Moving Head Disc Control	3	3	3	3		3
Fixed Head Disc Drive	2	1	1	1		1
Fixed Head Disc Control	2	1	1	1		1
Magnetic Tape Drive	3	1	1	1		1
Magnetic Tape Control	2	1	1	1		1
Computer-to-Computer Link	1	1	1	1		1
CRT Console	3	1	1	1		1
Line Printer	1					
Modem (for portable terminal)	2					
Hard Copy Terminal	1		1			1
Portable Terminal	1					
CATV Channel	1		1	1		1
Polling Channel						
Cabinetry & Misc.	1	0.7	0.7	0.7		0.7
Data Controller (initial--30 line card capacity)		1	1			1
Data Controller (supplemental--30 line card capacity)			1			
Line Card (local--4 line capacity)		30				30
Line Card (dialup or leased line--2 line capacity)			60			
Computer Supplies	1	0.5	0.5	0.5		1
Character Generator	1	1				1
Audio Response Subsystem (20 ports)	1	1	1			
Audio Generator	1					
Multiplexer (Character generator to refresh)	1	1				1
Multiplexer (polling data)	1			1		1
Modem (polling data)	1			1		1

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TABLE C (page 2)

SUBSYSTEM AND COMPONENT CHECK LIST

	A	B	C	D	E	F
	TICCIT Demo Two-Way Public Interactive CATV	TICCIT CAI Two-Way Institutional Interactive	Dial Access With One-Way Public CATV	One-Way Public Two-Way Institutional Interactive CATV	Two-Way Institutional CATV	Two-Way Institutional Interactive CATV
Video Modulator	120		10	20	120	120
Colorizer	120		10	20	20	20
Combiner Network	12		1	1	1	1
Test and Patch Facilities	1		1	1	1	1
Graphics Digitizer	1					
Miscellaneous Audio & Special Equipment	1		1	1	1	1
TERMINAL-RELATED EQUIPMENT						
TV Set--Color (for terminal use)		120		120	120	120
Luminance Refresh (one req'd per port)	120	120				20
Color Refresh (one req'd per port)	120	120				20
Refresh Control Electronics	1	1				1
TV Modifications (one req'd per set)		120				
Video Tape Player	2	20	10		2	2
Keyboard--TICCIT		120				
Crossbar Switch		1				0.1
Digital Switch Matrix	1					
TV Camera (including microphone)			10	20	120	120
TV Production Console			1			
Commercial Terminal (4 button with CATV modem)						
Commercial Terminal (12-20 button with CATV modem)	1000			120		
Commercial Terminal (full alphanumeric keyboard with CATV modem)						20
Commercial Acoustically Coupled Keyboard (12-20 button)						
Commercial Acoustically Coupled Keyboard (full alphanumeric)						
Teleprinter--local (purchase)						120
Teleprinter--local (rental)						

TABLE C (page 3)

SUBSYSTEM AND COMPONENT CHECK LIST

	A	B	C	D	E	F
	TICCIT Demo Two-Way Public Interactive CATV	TICCIT CAI Two-Way Institutional Interactive	Dial Access With One-Way Public CATV	One-Way Public Two-Way Institutional Interactive CATV	Two-Way Institutional CATV	Two-Way Institutional Interactive CATV
Teleprinter with Acoustic Coupler (purchase)			120			
Teleprinter with Acoustic Coupler (rental)						
Tone Telephone (12 button)						
Microphone				120	120	120
FM Modulator				120	120	120
Teleprinter Modem (CATV interface)						120
Video Tape Cartridge			10,000			20
Terminal Installation	1000		120	120	120	120
Cabling		120		120	120	120
TRANSMISSION CHANNEL-RELATED EQUIPMENT						
Data Access Arrangement (telco rental)			120			
Leased Telephone Line (local area, for teleprinter)(miles)			1,000			
Leased Telephone Line (local area, for CRT terminal)(miles)						
Leased 6MHz CATV Channel (per 1000 total CATV subscribers)	10		100	50		
Leased 6MHz CATV Channel (point-to-point, miles each way)				250		
Bidirectional CATV System Upgrading (per 1000 total CATV subscribers)	1			10		
CATV Subscriber Installation (basic service)					120	120
CATV Subscriber Provision for Privacy						
CATV Subscriber Annual Charge (basic service)						
Installed 1-way CATV System, Including Headend (miles)					50	50
Installed 2-way CATV System, Including Headend (miles)						

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TABLE C (page 4)

SUBSYSTEM AND COMPONENT CHECK LIST

	A	B	C	D	E	F
	TICCIT Demo Two-Way Public Interactive CATV	TICCIT CAI Two-Way Institutional Interactive	Dial Access With One-Way Public CATV	One-Way Public Two-Way Institutional Interactive CATV	Two-Way Institutional CATV	Two-Way Institutional Interactive CATV
SYSTEM AND SOFTWARE ITEMS						
Demonstration Operations & Maintenance	1	0.3	0.5	0.3	0.2	0.3
System Development (staff time)	1	0.3	0.5	0.3	0.2	0.3
System Software Development	1	0.3	0.3	0.2		0.3
System Development Supplies	1	0.5	0.5	0.3		0.3
Courseware	1	0.3	0.6	0.1		

TABLE D

TOTAL SYSTEM COSTS

	A TICCIT Demo Two-Way Public Interactive CATV		B TICCIT CAI Two-Way Institutional Interactive		C Dial Access With One-Way Public CATV		D One-Way Public Two-Way Institutional Interactive CATV		E Two-Way Institutional CATV		F Two-Way Institutional Interactive CATV	
	Capital	Operating	Capital	Operating	Capital	Operating	Capital	Operating	Capital	Operating	Capital	Operating
COMPUTER AND HEADEND EQUIPMENT												
Main Processor	48,750		43,875		43,875		43,875				43,875	
Terminal Processor	18,750		18,750		18,750		18,750				18,750	
Moving Head Disc Drive	90,000		45,000		45,000		45,000				45,000	
Moving Head Disc Control	31,875		31,875		31,875		31,875				31,875	
Fixed Head Disc Drive	12,500		6,250		6,250		6,250				6,250	
Fixed Head Disc Control	8,750		4,375		4,375		4,375				4,375	
Magnetic Tape Drive	24,750		8,250		8,250		8,250				8,250	
Magnetic Tape Control	6,000		3,000		3,000		3,000				3,000	
Computer-to-Computer Link	3,750		3,750		3,750		3,750				3,750	
CRT Console	11,250		3,750		3,750		3,750				3,750	
Line Printer	22,500											
Modem (for portable terminal)	5,000											
Hard Copy Terminal	6,250				6,250						6,250	
Portable Terminal	3,750											
CATV Channel	3,125				3,125		3,125				3,125	
Polling Channel												
Cabinetry & Miscellaneous	12,100		8,470		8,470		8,470				8,470	
Data Controller (Initial)			7,500		7,500						7,500	
Data Controller (supplemental)					2,500							
Line Card (local)			15,000								15,000	
Line Card (dialup or leased line)					30,000							
Computer Supplies	11,440		5,720		5,720		5,720				11,440	
Character Generator	8,750		8,750								8,750	
Audio Response Subsystem	70,000		70,000		70,000							
Audio Generator	3,125											
Multiplexer (character generator to refresh)	2,500		2,500								2,500	
Multiplexer (polling data)	2,500						2,500				2,500	
Modem (polling data)	2,500						2,500				2,500	

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TABLE D (page 2)

TOTAL SYSTEM COSTS

	A		B		C		D		E		F	
	TICCIT Demo Two-Way Public Interactive CATV		TICCIT CAI Two-Way Institutional Interactive		Dial Access With One-Way Public CATV		One-Way Public Two-Way Institutional Interactive CATV		Two-Way Institutional CATV		Two-Way Institutional Interactive CATV	
	Capital	Operating	Capital	Operating	Capital	Operating	Capital	Operating	Capital	Operating	Capital	Operatin
Video Modulator	150,000				12,500	1,000	25,000	2,000	150,000	12,000	150,000	12,000
Colorizer	150,000				12,500	1,000	25,000	2,000	25,000	2,000	25,000	2,000
Combiner Network (1 req'd/segment of CATV sys.)	75,000				6,250		6,250		6,250		6,250	
Test & Patch Facilities	2,500				2,500		2,500		2,500		2,500	
Graphics Digitizer	37,500											
Miscellaneous Audio & Special Equipment	12,500				12,500		12,500		12,500		12,500	
TOTALS	837,415		291,190		348,600	2,000	262,440	4,000	196,250	14,000	433,160	14,000
TERMINAL-RELATED EQUIPMENT												
TV Set--Color (for terminal use)			36,000	3,000			36,000	3,000	36,000	3,000	36,000	3,000
Luminance Refresh	97,560		97,560								16,260	
Color Refresh	12,720		12,720								2,120	
Refresh Control Electronics	11,250		11,250								11,250	
TV Modifications			10,080	840								
Video Tape Player	2,200	176	22,000	1,760	11,000	880			2,200	176	2,200	176
Keyboard--TICCIT			25,320	2,100								
Crossbar Switch			21,250								2,125	
Digital Switch Matrix	12,500											
TV Camera (including microphone)					10,000	800	20,000	1,600	120,000	9,600	120,000	9,600
TV Production Console					8,000							
Commercial Terminal (4 button with CATV modem)												
Commercial Terminal (12-20 button with CATV modem)	300,000	25,000					36,000	3,000				
Commercial Terminal (full alpha, w/ CATV modem)											7,200	600
Comm'l Acoustically Coupled Keyboard (12-20 button)												
Comm'l Acoustically Coupled Keyboard (full alpha.)												
Teleprinter--local (purchase)											115,200	9,600
Teleprinter--local (rental)												

TABLE D (page 3)

TOTAL SYSTEM COSTS

	A TICCIT Demo Two-Way Public Interactive CATV		B TICCIT CAI Two-Way Institutional Interactive		C Dial Access With One-Way Public CATV		D One-Way Public Two-Way Institutional Interactive CATV		E Two-Way Institutional CATV		F Two-Way Institutional Interactive CATV	
	Capital	Operating	Capital	Operating	Capital	Operating	Capital	Operating	Capital	Operating	Capital	Operating
Teleprinter with Acoustic Coupler (purchase)					172,800	14,400						
Teleprinter with Acoustic Coupler (rental)												
Tone Telephone (12 button)(extra cost over rotary dial type)												
Microphone							10,560	840	10,560	840	10,560	840
FM Modulator							75,000	6,000	75,000	6,000	75,000	6,000
Teleprinter Modem (CATV interface)											45,000	3,600
Video Tape Cartridge					460,000						920	
Terminal Installation	20,000				2,400		2,400		2,400		2,400	
Cabling			4,200				4,200		4,200		4,200	
TOTALS	456,236	25,176	240,380	7,700	664,200	16,080	184,160	14,440	250,360	19,616	450,435	33,416
TRANSMISSION CHANNEL RELATED EQUIPMENT												
Data Access Arrangement (telco rental)						4,320						
Leased Telephone Lines (for teleprinters)						17,000						
Leased Telephone Lines (for CRT terminals)												
Leased 6MHz CATV Channels (for cablecasting)		32,000				120,000		160,000				
Leased 6MHz CATV Channels (point-to-point)								30,000				
Bidirectional CATV Syst. Upgrading*	87,500	7,000					875,000	70,000				
CATV Subscriber Installation (basic service)									1,200		1,200	
CATV Subscriber Provision for Privacy												
CATV Subscriber Annual Charge (basic service)												
Installed 1-Way CATV System, including Headend									625,000		625,000	
Installed 2-Way CATV System, including Headend												
TOTALS	87,500	39,000				341,320	875,000	260,000	626,200		626,200	

* Approximately half the cost if system initially designed for two-way applications

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TABLE D (page 4)

TOTAL SYSTEM COSTS

	A TICCIT Demo Two-Way Public Interactive CATV		B TICCIT CAI Two-Way Institutional Interactive		C Dial Access With One-Way Public CATV		D One-Way Public Two-Way Institutional Interactive CATV		E Two-Way Institutional CATV		F Two-Way Institutional Interactive CATV	
	Capital	Operating	Capital	Operating	Capital	Operating	Capital	Operating	Capital	Operating	Capital	Operat
SYSTEM AND SOFTWARE ITEMS												
Demonstration Operations & Maintenance		450,000		135,000		225,000		135,000		90,000		135,(
System Development (staff time)	300,000		90,000		150,000		90,000		60,000		90,000	
System Software Development	300,000		90,000		90,000		60,000				90,000	
System Development Supplies	20,000		10,000		10,000		6,000				6,000	—
Courseware	700,000		210,000		420,000		70,000					
TOTALS	1,320,000	450,000	400,000	135,000	670,000	225,000	226,000	135,000	60,000	90,000	186,000	135,(
GRAND TOTALS	2,701,145	514,176	931,570	142,700	1,682,890	584,400	1,547,600	413,440	1,132,810	123,616	1,[illegible],795	182,4

TABLE E SYSTEM CONFIGURATION SUMMARY	A	B	C	D	E	F
	TICCIT Demo Two-Way Public Interactive CATV	TICCIT CAI Two-Way Institutional Interactive	Dial Access With One-Way Public CATV	One-Way Public Two-Way Institutional Interactive CATV	Two-Way Institutional CATV	Two-Way Institutional Interactive CATV
Computers	2	2	2	2		2
Ports (total)	120	120	120	120		120
Public Subscribers Served	1000	1000	10,000	10,000		
Public Subscribers Equipped	1000		dial access			
Central Refresh Units	120	120				20
CATV Channels (public) *Two-Way Required	10*		10	5		
CATV Channels (point-to-point)				5	30	30
Leased Lines			120			
Keyboards-Small	1000			120		
Keyboards-Large		120				20
TV Sets or Terminals	Supplied by Subscribers	120	Supplied by Subscribers	120	120	120
Primary Locations	1000	120	1	20	20	20
Secondary Locations			120	100	100	100
Video Modulators	120		10	20	120	120
Video Colorizers	120		10	20	20	20
Video Tape Players	2	20	10		2	2
Audio Response Ports	20	20	20			
TV Cameras			10	20	120	120
Microphones				120	120	120
Teleprinters			120			120

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